The Chemical Age

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# Materials of Chemical Plant Construction

TO make any extended reference here to the interesting papers and discussions presented to the Chemical Engineering Congress would be manifestly impossible. Instead it is proposed to discuss a few of the lessons that may be learned from some of the sections. The papers submitted on the subject of ferrous metals in chemical plant construction are in a way a symposium on the advances made by the metallurgist in the service of chemistry within the lifetime of even the youngest chemical engineer.

Dr. Hatfield's encyclopædic description of the nature and uses of heat-, rust-, and acid-resisting steels opened with the comment that it is only a little over 20 years since the corrosion-resisting possibilities resulting from the addition of chromium to steel were first clearly recognised, and the use of these alloys has increased with astonishing rapidity during the past decade. It is interesting to note that speakers detected a parallel tendency to use what might be termed "alloy" refractories of composite nature, such as chrome-silica and lime-magnesia; but, of course, developments comparable to those resulting from the addition of chromium to steel are not to be expected. The section dealing with ferrous metals was not well discussed and, casting aside as unworthy the thought that chemical engineers have neglected to study metallurgy, we prefer to put the blame upon the quite astonishing virtuosity displayed by the metallurgists. Nevertheless, Sir William Larke gave a lead which should be followed by everyone who has any experience to contribute when he said that no greater stimulus to progress could be devised than the criticism of those who are using materials; in its committees the Iron and Steel Federation incorporates research workers, steel makers and steel users.

Lord Leverhulme asked that the chemical engineers of the future should become pressure-minded, and with pressures there also come increased temperatures. Such temperatures may be not more than 200° or 300° C. or they may rise to those met with in working with superheated steam. As an extreme instance, Captain Cadman described an oil-cracking still that he had attempted to operate on the semi-technical scale at 800° C., but that became so brittle that when tapped with a hammer to remove deposited carbon, it broke like glass—which was not surprising.

The paper (A6) on some aspects of the behaviour of carbon and molybdenum steels at high temperatures shows the remarkable progress that has been made in determining and increasing the safe range of stress and in removing the engineer's limitations in regard to his materials. But the chemical engineer must play his part. Dr. Hatfield, when asked when the chemical engineer would have available forgings capable of withstanding a pressure of 10,000 atmospheres at a temperature of 300° C., replied that the present steels were amply sufficient for the purpose—if the chemical engineer would design suitably. Even stainless steel will not resist anærobic corrosion, and the use of bitumen- or pitch-covered pipes in certain soils and clays is still essential. During one of the investigations recorded, a curious abnormality of certain steels in having an exceptionally low—and up to the present, inexplicable—resistance to creep when tested at 450° C. was noted, and this observation was regarded by Dr. Hatfield as singularly important.

The work of the British Cast Iron Research Association was described by the director, Dr. Pearce, and the success that has been achieved in this field of metallurgy prompted the general reporter to say that apparently the engineer can now do with cast iron almost what can be done with steel. The new process for production of a fine graphite structure by adding 0.2 per cent. of titanium in the melt followed by treatment with an oxidising gas such as $CO_2$, should improve the corrosion-resistance of cast iron immensely, for corrosion follows the graphite boundaries. Finally, Dr. Hatfield declared that, given full consultation between user and steel maker, no engineer need now have an embrittlement problem. We suspect, however, that even yet the chemist must here sometimes modify his demands.

In the non-metallic section, the great improvement in chemical stoneware was an outstanding feature. This improvement is recent, and has not been fully noised abroad. It has received no Press notice. It has been due to scientific methods, to regularity in manufacture, composition and shape. The thermal conductivity of stoneware has been increased 4- or 5-fold by addition of patented substances. The role of plastics and of rubber in chemical plant was fully discussed and the opinion was expressed that these substances were complementary and not competitive, though we are not so sure that *vulcanised* rubber may not be fully competitive with plastics. The question of the phenolic odour given to foodstuffs by phenol resins was discussed, but no really clear evidence was given that the difficulty had been overcome. Obviously the problem is that of ensuring that the phenol always fully reacts with the formaldehyde. Reference was made to the value of bitumen in chemical works as an anti-corrosive.

Space does not permit examination of the many excellent papers on non-ferrous metals, but aluminium

came in for particularly full treatment. A new process was disclosed for cleaning aluminium surfaces. This is an operation which may give rise to trouble because aluminium depends upon a surface oxide film for immunity from attack by many chemical substances. This process involves the use of dibenzyl sulphite which inhibits the action of hydrochloric acid used for removing scale. The engineer who handles nitric acid is given the choice of three materials—aluminium, stainless steel, and stoneware; unfortunately the discussion gave no guidance which of the three is preferable. If the discussion on these two sections did nothing else, it showed how active are all branches of plant materials manufacture in improving their products.

# Notes and Comments

## Success of the Congress

THE first international Chemical Engineering Congress ended on Saturday, and everyone with whom we were able to exchange greetings agreed that it had been highly successful. Important as were the 127 technical papers presented and discussed in the course of the twelve sessions, the real enduring value of the Congress lay in the breaking down of international barriers and the meeting on common ground of the chemical engineers of some thirty or more different countries of the world. The Institution of Chemical Engineers, the British National Committee of the World Power Conference and all who had any share in organising the Congress may well feel that they have made a worth-while contribution to the task of international revision and consolidation, which was the primary object of the Congress, while the overseas visitors will return to their respective tasks feeling that the time and money expended on the visit to Great Britain has not been in vain. Most of the overseas visitors have returned, but the delegation representing the American Institute of Chemical Engineers has remained for a combined business and pleasure tour of England during the present week, culminating in a visit to the annual meeting of the Society of Chemical Industry at Liverpool, which opens on Monday.

## An Invitation to Berlin

CHEMICAL engineers the world over will be pleased to learn that at the closing meeting of the Congress on Saturday a cordial invitation was received from the German representatives to hold the second international Chemical Engineering Congress in Berlin in 1940. Four years is a very short period in history, but we entertain no doubt that in the interval that will elapse before the next congress there will be tremendous progress in the realms of chemical engineering—probably a great deal more than in the past four years—and that there will be no lack of material for discussion in Berlin. In the meantime the process of consolidation and revision will be facilitated by the favourable impressions carried away from the London congress, and many of the lessons learnt in the past few days will be put into practice. Great Britain has had the pleasurable but by no means easy task of organising one of the most remarkable congresses ever held, and there will be no misgivings that Germany will fail in upholding the high standard set at the first assembly.

## The Liverpool Meeting

FOR the sixth time in its fifty-five years' history the Society of Chemical Industry will hold its annual meeting at Liverpool next week. Its first meeting there was in 1886, and it returned in Liverpool in 1893, 1902, 1913 and 1924. The Liverpool section of the Society, like the London section, dates from 1881, the year in which the parent Society was founded, and it now has a membership of 310, presided over by Professor C. O. Bannister, with Mr. J. S. Towers as secretary. Judging from the programme, the meeting promises to be in keeping with the tradition set by Liverpool on previous occasions. The social side is well catered for, the visits to the "Franconia" and to the various works in and around the city will doubtless attract large parties, while Mr. W. A. S. Calder's presidential address and the Messel Medal lecture by Sir Robert Mond, will add materially to the Society's literature. On the domestic side, the Society will again be confronted on Tuesday morning with a financial statement which shows an excess of expenditure over income. In the past year it has had to draw on its balance to the extent of £441, against £136 in the previous year, mainly on account of its publications. There has, however, been a slight but welcome increase in members' subscriptions.

## The Chemical Council

PROBABLY at no other time in our chemical history has the relationship between professional chemistry and industry been happier than it is at present. There is mutual goodwill and respect between the two, and it is certain that good feeling of this kind is, in the highest degree, for the national good. Thus writes Professor J. F. Thorpe, hon. treasurer of the Chemical Council, in commending the Council's appeal to industry for funds in the Journal of the Institute of Chemistry. Those engaged in industry are to be asked to consider the debt they owe to chemical science both for present services and for those rendered in the past. The Council estimates that it will need a yearly income of from £3,000 to £4,000 to place the finances of the chartered chemical bodies controlling chemical publications on a basis which will remove the restrictions caused at the present time by lack of adequate funds, and it hopes, therefore, to establish a fund of £100,000, the interest on which will be used to provide the extra income required for adequate publication of new chemical knowledge. Another capital fund of the order of £100,000 will then be formed, the income from which will be used to relieve the cost of the chemical library and eventually to provide for the establishment of a sinking fund for suitable premises. The Chemical Council has not only started to function but is well on the way towards the accomplishment of those objects for which it was established. The appeal that is shortly to be issued will be no begging letter. It will be a call for help from those who have hitherto borne ungrudgingly the heat and burden of the day to those whom they feel should now share some of that burden.

# The Chemical Engineering Congress

## Next Meeting to be held in Berlin in 1940

THE final meeting of the Chemical Engineering Congress was held on Saturday, June 27, when Sir Harold Hartley, chairman of the International Executive Council of the World Power Conference, presided.

Mr. W. A. S. CALDER, chairman of the Technical Committee, in a brief report on the technical sessions, referred to the work of Lord Leverhulme as president of the Congress. Lord Leverhulme was one of our great British noblemen whose motto might well be " I Serve." The Technical Committee had also always felt that behind all its deliberations it had had the weight and wealth of experience of Sir David Milne-Watson, who had guided the work of the committee in an admirable manner. The committee had also had the benefit of the wisdom and foresight of Dr. E. W. Smith. It was unfortunate that Dr. Smith fell ill, and the committee was deprived of his help for many months, but the flywheel effect which Dr. Smith started did not run down, and everybody was pleased to see him at some of the meetings of the Congress. The committee had also had great help from Sir Alexander Gibb. The committee owed a great deal to Sir Harold Hartley and to Mr. Gray, secretary of the World Power Conference, whilst he himself, as chairman of the Technical Committee, had the great privilege of having the assistance of a scientist like Dr. Sinnatt, and to him and also to Professor Ure he personally was greatly indebted. He had also to recognise the services of Mr. Ford as editor and secretary, and finally there was Mr. M. W. Burt, the general secretary of the Congress, a name which would always be very present in his mind as a monument of efficiency and a delightful companion, a great diplomatist and a most efficient organiser.

### Resolutions of Thanks

The CHAIRMAN then moved the following resolution : " This closing meeting of the Chemical Engineering Congress of the World Power Conference desires to place upon record its gratitude to the authoritative bodies which have sponsored the papers presented by authors of fourteen countries, and to the authors themselves who have devoted so much time and care to the preparation of their contributions to the success of the first international Chemical Engineering Congress. This meeting also thanks the chairmen and vice-chairmen who have presided so ably at the technical sessions; and the general reporters, whose digests of the papers within each section and whose suggestions for topics have provided so fruitful a basis for the discussions. Finally, this meeting thanks the British Chemical Plant Manufacturers' Association for the exceedingly interesting exhibition of British chemical plant held concurrently with the Congress."

The resolution was carried unanimously.

Sir DAVID MILNE-WATSON then moved the following resolution : "This closing meeting expresses its deep gratitude to the National Committees of the World Power Conference for the enthusiastic preparations for the World Power Conference which they have made in their respective countries; particularly by arranging for the preparation of papers by their leading authorities and by promoting the attendance of members. It recalls with pride the presence of three hundred and fifty members from thirty-six countries, in addition to five hundred members from Great Britain. This meeting also thanks the individual participants from overseas, by whose presence and participation in the proceedings the Congress has been crowned with success as a gathering representative of chemical engineering throughout the whole world."

The resolution was carried.

Professor W. I. MULLER (Austria) moved the following resolution, which was supported by representatives of Canada, China, Czecho-Slovakia, Denmark and Poland: " This closing meeting desires to place upon record its high appreciation of the support accorded to the Congress by His Majesty's Government in the United Kingdom, and particularly by the Lord President, the Right Hon. J. Ramsay MacDonald. It also expresses its thanks to the president of the Congress, Viscount Leverhulme; to the organising committee and its chairman, Sir David Milne-Watson; and to the other Congress committees and their officers."

This resolution was acknowledged by Lord Leverhulme and Sir David Milne-Watson.

### A New Alliance

The CHAIRMAN, in bringing the Congress to a close, expressed thanks on behalf of the executive committee of the World Power Conference to all who had been responsible for the organisation of the Congress and expressed the view that the organising had come very near to perfection, so smooth and punctual had been its course. If the union of the World Power Conference with chemical engineering was utilitarian in its origin, this union had now developed into a permanent alliance based on a solid foundation of the many interests which they all had in common. The World Power Conference welcomed this new alliance since it widened the scope of its own organisation and would be an added strength in years to come. The Congress could not have met at a time when it was more important that the nations of the world should learn to know one another better and learn to sympathise with each other's outlook and difficulties. Almost every speaker during the week had emphasised what the great developments of chemical engineering had meant to our general well-being and their limitless potentialities in the future. Yet it was no exaggeration to say that all the advantages which technical progress offered to the world might be endangered by the present trend towards isolation of one country from another, the result of lack of confidence and of a failure to understand what the ultimate effects of such a policy must be.

Finally, the chairman expressed satisfaction that there had been received from their German colleagues a very welcome invitation to hold the second international Chemical Engineering Congress in Berlin in 1940. Thanks to that, they could all go away from this conference saying " Auf Wiedersehen " and looking forward to another meeting as happy and successful as this one had been.

# The Official Banquet

THE official Congress banquet, at which there were over 500 guests, was held at Grosvenor House on June 25. The president, Lord Leverhulme, was in the chair.

Lord RUTHERFORD, F.R.S., who proposed the toast of " The Chemical Engineering Congress," said that when one surveyed the progress of chemistry, and particularly industrial chemistry, during the last 20 years, it was seen what a great change had come over the scene. In the days of his youth the laboratory process was translated into the industrial process by either using the same sort of material in larger quantity or rather larger apparatus so that the material and methods of the industrialist were much the same, although on a magnified scale. If we went round our industrial works to-day, however, the position was very different. There were now to be seen autoclaves specially designed by the chemical engineer, or pressure vessels in which experiments were conducted on a large scale at very high pressures and temperatures, and in many cases temperatures so high that the steel

was almost red hot. These developments had led to the rise of a new type of man—the chemical enginer. But the chemical engineer was neither flesh, nor fowl, nor good red herring. At the same time he was that unusual creature, the superman, for he had not only to know almost as much—or pretend to know almost as much—as the organic chemist, but he had to have—or pretend to have—that knowledge of physics and engineering that was required to construct the complex apparatus used in modern industry.

Sir DAVID MILNE-WATSON, who responded to the toast, said that as an industrialist he had much reason to appreciate the value of applying fundamental scientific knowledge to industrial problems because he had seen the heat treatment of coal transformed in the last decade or two by such scientific application—such as the hydrogenation of coal and oil—and because he could see, just ahead of us, further great developments.

Moreover, as a commercial man accustomed to think that the end of the process of production was the satisfaction of demand and the creation of new values, he was continually struck by the changes that had come over human habits and ideas as the result of developments in physics and chemistry, applied practically through the work of chemical engineers.

The Rt. Hon. J. RAMSAY MACDONALD, M.P., Lord President of the Council, proposed "Our Visitors from Overseas," and after extending a cordial welcome to all those attending the Congress from other countries, both on behalf of His Majesty's Government and of the Congress executive, said that chemical engineers were raising industry from a mere material basis on to a broad, mental, intellectual and spiritual basis, giving it a new idea, a new spirit, a new technique, and it would require the coming generations to appreciate the height and the depth and the breadth of the services which chemical engineers were now rendering to industry generally throughout the world.

Dr. J. V. N. DORR (United States), making the first response to the toast, said chemical engineering was the latest of the great divisions of engineering to receive recognition in the technical world, and some of those present might recall the opposition met with from both chemists and engineers when the American Institute of Chemical Engineers was first established. Chemical engineers were then derisively described as "good engineers among chemists and good chemists among engineers." But in both England and America that time was past and to-day, as in Biblical times, it could be said, "By their fruits ye shall know them," for the great growth of chemical engineering plants had been the outstanding industrial development since the age of steam.

Dr. H. NORDENSEN (Sweden), who also responded, said the overseas engineers had been specially glad that the first Chemical Engineering Congress had taken place in Great Britain.

The final toast was "The Chairman," which was proposed by Dr. HERBERT LEVINSTEIN.

Lord LEVERHULME briefly responded and stressed the importance of the Congress in bringing about human friendship which would lead to peace throughout the world. He expressed thanks to the organising committee for the wonderful work it had done, to the World Power Conference for allowing this Congress to be held under its auspices, and also to the work done by Mr. Gray, secretary of the World Power Conference, and Mr. Burt, general secretary of the Congress.

# Education and Training—Section J

**By Professor H. E. WATSON**

**Professor H. E. Watson.**

*J1.* Education and Training of the Chemical Engineer in Austria. (Austria.) By Prof. W. J. Müller. *J2.* Problems of the Education and Training of the Chemical Engineer in Germany. (Germany.) By A. Eucken. *J3 (a)* Education and Training of the Chemical Engineer. (Gt. Britain.) By H. W. Cremer and A. J. V. Underwood. *J3 (b).* Technical Education in the Gas Industry. (Gt. Britain.) By C. H. Creasey. *J3 (c).* Education and Training for the Oil Industry. (Gt. Britain.) By Prof. A. W. Nash. *J4.* Education and Training of Chemical Engineers in Japan. (Japan.) By Saburo Uno. *J5.* Chemical Engineering Education in the United States. (United States.) By Prof. A. H. White.

The subject matter of these papers may be broadly divided into two groups:—(a) general technical education, and (b) training of university standard, specially directed towards bridging the gap between chemists and engineers.

The rapid growth of technical education in Japan since 1912 is emphasised by S. Uno (*J4*); applied chemistry and engineering courses form a large proportion of the whole, and chemical engineering is also taught.

Chemical engineering in the United States is undoubtedly far better organised and further developed than in any other country. There are over 10,000 students taking chemical engineering courses, comprising 17 per cent. of the whole number of engineering students. It is interesting to note that, twenty-five years ago, training in chemical engineering was very similar to that which is now given in other countries. The course was composed of a selection from existing chemical and engineering courses, and the teachers had been mainly trained as chemists. The great development which has since taken place appears largely due to the recognition of chemical engineering as a separate subject. Athough this system has been most successful in America, it does not follow that it is the only one, or that it would necessarily be the best in other countries. Dr. Eucken (*J2*), in his carefully classified account of the methods followed in Germany, shows that valuable results have been obtained in other ways.

In England, in spite of the existence of an Institution of Chemical Engineers which has advocated for the last decade instruction in chemical engineering on lines similar to those adopted in America, students have been largely trained as chemists, and an attempt then made to apply a finish of chemical engineering.

### Points from the Discussion

Mr. G. G. BROWN (United States) emphasised the inadvisability of standardising methods of training chemical engineers as by so doing there was a danger that the student would lose the quality of imagination, critically and quantitatively, and thus be unable to handle new developments when they came along. In America chemical engineering training had proceeded on the lines he had mentioned, and on what might be called the "case" method of teaching in the legal profession. It was felt in America that it was necessary to give a general training for four years and not to specialise until after that period.

Professor A. GILLET (Belgium) said it was necessary to bear in mind that chemical engineers had to deal with machinery, and training in the design and construction of such plant should be an essential feature of chemical engineering training.

Professor Dr. W. MULLER (Austria) suggested that the period of training for a chemical engineer should be four years in chemical engineering, and another four years in mechanical engineering. Moreover, attention should also be paid to the quality of the teachers. He also suggested alternate periods in the university and the works during the training period.

Mr. C. S. GARLAND pointed out that the chemical engineer is first and foremost an engineer, and added that this was an important distinction drawn in the paper by Cremer and Underwood. Every care should be taken that the critical outlook of students should not be dulled by the method of training. He had been impressed with the manner in which men who had a chemical degree only were proud to call themselves chemical engineers, whereas an engineer with some chemical training often scorned to be called a chemical engineer.

Professor A. EUCKEN (Germany) said that regard should be had, in preparing the details of the training of chemical engineers, to the fact that there was not one type of chemical engineer but many.

Professor N. USHKEVITCH (U.S.S.R.) said the training of chemical engineers in Russia occupied five years, of which three were devoted to general education and the remaining two years to some form of specialisation. There were 70 chemical departments of universities in Russia and 60 technical high schools, where there were some 20,000 students. There were about 300,000 workers in the chemical industry there, and efforts were being made to train a large number of chemical engineers.

Mr. L. F. GOODWIN (Ontario) spoke of the need for training specialised men, having regard to the nature of the industries there, but there should be a broad training in the first place. He also advocated students going into the works during the summer, there to learn how to control men. Speak- of the men who spent a fifth year in their training, he said some firms would not pay these men a higher initial salary than those who had only fours years' training, although there were those concerned with the educational side who believed that such men should get a higher salary. The view of those firms who refused was that these fifth year men should quickly rise to better positions.

# Statistics, Administration, Safety and Welfare—Section K

**By W. H. GARRETT**

**Dr. W. H. Garrett.**

*K*1. Occupational Risks in the Chemical Industry and their Prevention. (Germany.) H. Martius. *K*2. Statistical Method as an Aid to Control of Industrial Efficiency. (Gt. Britain.) E. S. Pearson. *K*3. Planning and Control of Chemical Manufacture. (Gt. Britain.) T. Donaldson. *K*4. Some Aspects of Accident Prevention in Industry. (Gt. Britain.) C. S. Robinson and H. R. Payne. *K*5. Cost Analysis for Process Expense Control. (United States.) Prof. W. P. Fiske. *K*6. Influence of Location upon the Cost of Production. (United States.) J. L. Warner. *K*7. Considerations Influencing the Formulation of Chemical Engineering Projects. (United States.) Crosby Field.

It appears to be generally accepted that guarding of machinery, etc., has developed to a point where accidents due to machinery in motion are now a minor consideration. The main causes of industrial accidents to-day are carelessness of the injured person or a third party, and non-observance of safety rules. Few accidents are due specifically to the nature of any one process. Attention is drawn particularly to electrical risks, including those attendant on the use of high voltages, and to the dangers arising from the formation of static charges, an interesting point being the avoidance of crossed belts. The recent development of high-pressure processes has also brought its attendant risks.

## Accident Prevention

Emphasis is laid on the fact that the chemical trade in particular requires, by the great variety and peculiarity of its attendant risks, a special code of safety rules. However, in Germany the industrial associations attempt to draft comprehensive regulations governing groups of factories with similar risks, whereas the trend in England is for each factory to deal specifically with its own risks. The point is brought out that a very important feature in the chemical industry is reliability of equipment, as serious accidents may result from the stopping of a stirrer, etc. Many advantages are claimed from the standardisation of guards and protective appliances, and much work has been done in this direction. Emphasis is laid on cleanliness and tidiness in factories. The regular inspection of equipment, lifting tackle, etc., enables faults to be detected and rectified before an accident happens. This is particularly important where dusty or corrosive atmospheres prevail.

A wide divergence exists as between the German industry and the British in the treatment of accidents. The British practice stops short at first-aid, of varying degrees of efficiency, whereas the German industry is responsible right to the final cure of the injury. The importance of specialised medical attention for industrial accidents, however, appears to be generally accepted. Other points brought out include the advisability of well-equipped central first-aid stations, prohibition of unauthorised treatment of injuries, the training of factory employees in first-aid and rescue work, and the importance of serious investigation into accidents and near-accidents.

## Industrial Diseases

These are regarded in the same light as accidents, and here again the difference between the British "first-aid" and the German "cure" principle is marked. With industrial diseases, however, there is more likelihood of the causes being outside the injured person's control, and much attention has been devoted to the development of suitable gas masks and breathing apparatus. The dangers under this heading are more insidious, and the results often more serious and more

prolonged. Here again, the advantages of the application of specialised medical knowledge are emphasised.

The legal aspect of safety work in British and German industries shows wide divergence. Factory inspection and regulations in this country are a direct Government activity, under the Home Office. In Germany the establishment of industrial associations, formed from industries whose risks are similar, is required by law, and the drafting of safety regulations, and the inspection of factories are, in the main, functions of these industrial associations. Again, while in both cases legislation covers compensation to the injured, the British practice is for individual corporations to deal with compensation either by carrying their risks, or being covered by an insurance company; whereas in Germany all compensation risks are covered by the industrial association for the factories under its control.

In connection with the voluntary aspect of safety work, attention is drawn to the work of such organisations as The National "Safety First" Association, the National Safety Council of America, and the safety service of the International Labour Organisation. The number of voluntary safety associations in various countries has quadrupled in the past ten years. The assistance given to voluntary safety work by Government inspectors and by the Home Office Industrial Museum is acknowledged.

## Safety Organisations

Types of safety organisation vary considerably, and different methods appear to give the best results in different circumstances. The trend in British and American factories is towards the appointment of a safety officer, preferably with some engineering experience, acting with, or without, a safety committee composed of both management and employee representatives. The safety engineer in German organisations fulfils the same rôle, but committees are of a purely advisory nature. A favoured American practice is that of controlling safety on a disciplinary basis, and in certain circumstances this method is very successful. The industrial associations of Germany bring all industries with similar operations and risks under a central organisation, and some steps in this direction have been made in the British chemical industry.

## Methods of Cost Analysis

Five main avenues of approach for cost analysis are: (1) profits; (2) unit costs; (3) historical cost comparisons; (4) standard costs; and (5) budgets.

Under (1), as the two main factors affecting profits, come prices and business volumes, and as these factors are outside the production man's control, changes in profits cannot truly indicate managerial efficiency without further analysis. Such further analysis of these uncontrolled factors is both difficult and lengthy.

Under (2), unit costs are not affected by changes in selling price, but are seriously affected by such influences as change in volume of production, joint use of space and equipment for more than one project, price paid for raw material, labour rates, etc. It is concluded that unit costs do not provide a satisfactory foundation.

Under (3), historical comparisons showing current performance as against previous performance are most widely used, and are much better than profits or unit costs, if the distinction between controllable and uncontrollable factors is duly recognised.

Under (4), standard costs are predetermined costs based mainly on experience and actual observations. They give a goal at which the production man may aim, and constitute a standard to measure his success in maintaining a reasonable level of efficiency. They also have the advantage of focussing attention on the variations from standard and indicate the particular operation activity which is at fault. Standard costs also enable accounting returns to be made more speedily.

Under (5), the use of budgets has greatly increased in recent years. Great advantages are possible from the actual budget planning, as this indicates a definite course and an objective at which to aim. A well-designed budget, allowing for all expected conditions, is probably the best all-round plan, but its value falls when actual conditions differ from those taken into consideration.

## Applications of Cost Analysis

The applications of cost analysis are many and varied. These include analysis for inventory valuations, for fixing selling prices, income tax, insurance losses, mergers, reorganisations, etc. The two applications of perhaps the greatest importance are for control of expenses and for assisting in arriving at a decision in problems of economic balance and alternative choice. This last may, for example, be the choice between two alternative methods of manufacture, or between two locations for the same manufacture. In applying cost analysis to control and efficiency in industrial operations, proration has frequently to be adopted, and in such cases costs should be charged immediately to the product, if possible.

Emphasis is laid on the fact that no all-purpose cost analysis is possible. The principles and technique adopted vary with the purpose of the analysis, and many of the complaints made that cost analyses are of little value are due to attempts to apply them for purposes for which they were not designed. For example, unit costs made for inventorial purposes may be quite unsatisfactory for the purpose of control or economic balance. It is also important to realise that control by cost analysis can only be effective as far as the standards used as a basis for measurement are sound. The necessity for promptness in returning control reports is emphasised, for a slightly less accurate return issued promptly is of more value in control than a meticulous delayed report.

Rising cost of distribution has encouraged market research both in regard to existing sales density and probable growth in different areas. If distribution is to be effected over a wide area, it may pay a manufacturer to divide his production among a number of well-located plants. If a market is already over-supplied, it is not advisable to locate a plant there, but it must be borne in mind that prompt delivery at short notice is often essential. It is often advisable not to use the normal trade channels in introducing a new product to the market, and nowadays, when competition has practically cleared the markets of poor-quality goods, it is difficult to convince a customer that a real difference of quality does exist. It is important to consider whether a new product is one for which advertising can create a sudden demand, or whether the growth of demand will follow the more usual gradual curve.

## Raw Materials

With "consumer" goods, consideration of availability of raw material, though important, is rarely a deciding factor in a chemical engineering project, as the cost of distribution usually outweighs raw material charges; this does not apply with the same force where "producer" goods are in question. Industries using large bulks of low-priced raw materials should usually be placed near the source of supply, and a continuous supply, if arranged, will eliminate the expense of holding large stocks. If such industries have to import the raw materials, location on the seaboard is advisable. Where raw material prices are subject to speculative markets, large stocks should be built up when the market is favourable; industries using the by-product of another industry should be located near the source of supply, this applying also where raw materials of a perishable nature are used. In general, as the cost of raw material increases, as a percentage of the total cost, so does the importance of adjacent raw material supply increase.

Large buildings should be built on flat land to avoid cost of levelling, and factories covering large floor areas cannot, as a rule, be built in cities where land values are high. In erecting plant buildings, due allowance should be made for

reasonable expansion, and the type ot construction employed should depend on the nature of the process involved, making the construction as fireproof as possible. Good general layout and wide alleys between buildings reduce fire risks. Good lighting and ventilation are necessary for efficient working. Equipment should be well designed for its particular duty, and regular equipment expenditure reduces maintenance costs. The control of expenditure on plant and buildings is usually controlled by an annual budget with due allowance for minor maintenance charges and for emergencies. Factories should, if possible, be located in positions where effluent disposal facilities exist; local regulations on this point should be studied.

### Points from the Discussion

Dr. F. MARTIUS (Germany) said that after 50 years' experience in Germany the conclusion had been come to that accident avoidance and compensation should rest with the industrial groups concerned, and these groups were better able to study and handle their problems than any Government officials.

Dr. E. F. ARMSTRONG said it would be valuable if the meeting could have a statement on accident prevention in Germany and a similar statement as regards Great Britain, indicating the practice in the two cases. He hoped the authors of the papers dealing with the British position would forgive him saying that their modesty had prevented them bringing out how much had really been done in this country and, indeed, a good deal more advance had been made than they had indicated. It was an important question as to whether the best way of preventing accidents in industry should be by way of Government control or by the industries themselves. In England we did not like Government interference, but the Home Office was quite willing, if an industry showed itself capable of being able to take care of its own affairs, not to introduce unnecessary legislation. The chemical industry had the advantage of a very strong committee which had worked out a code of model rules for the prevention of accidents and the result had been to avoid legislation and special factory Acts for the chemical industry. He believed opinion in this country was that provided an industry honestly and sincerely tried to look after its own affairs, no Government legislation was necessary.

Mr. W. A. S. CALDER, on the question of accidents, urged the greater desirability of applying methods of restoration to men, who were to all intents and purposes dead, not for 30 or even 60 minutes, but for many hours, as within his experience there had been cases where men had been revived by such prolonged attention.

Mr. J. DAVIDSON PRATT suggested that safety should be regarded in the same way as medical science; no secrets and no international barriers. He urged firms to be more willing to disclose the details of their accidents, not for publication but for record and investigation within the industry. It was because of this that many accidents which had occurred in this country were still without adequate explanation.

Mr. C. S. ROBINSON (I.C.I.), speaking on the question of industry carrying its own risks and paying its own compensation, said his company had 60 factories divided into eight operating groups with almost autonomous control, locally. There was a central insurance department for compensation purposes and payment into the insurance fund was on the basis of the record of the particular group. For instance, one group might pay below the average required by legislation, and another one on a higher rate.

Mr. J. G. VAIL (United States) said the problem of silicosis was being examined very carefully in the United States by an institution known as the Air Hygiene Foundation, and it had been definitely ascertained that when the dust was below 2 million particle of michron size per cubic foot, silicosis did not develop. Therefore every factory manager could reduce this risk by keeping down the concentration of dust.

# Trend of Development—Section L

**By H. W. CREMER**

**Mr. H. W. Cremer.**

OWING to the diversity of the subject matter included, this section does not lend itself to systematic treatment. It is possible, however, to sub-divide the papers into the following main groups:—

GROUP I.—WATER TREATMENT, INCLUDING HEAT FLOW IN STEAM PLANTS. *L*2. Water-softening in a Modern Lager Beer Brewery. (Denmark.) By Prof. C. Jacobsen. *L*4. Water Treatment. (Gt. Britain.) By L. O. Newton. *L*5. Some Principles of Water-conditioning. (Gt. Britain.) By P. Hamer. *L*8. Recent Methods of Feed-water Treatment and their Place in the Heat Flow of Steam Plants. (Austria.) By H. Riemer. *L*13. On Heat Economy and on the Treatment of Feed-water and Boiler-water in the German Chemical Industry. (Germany.) By A Splittgerber.

GROUP II.—THE HEAVY CHEMICAL INDUSTRY. (*a*) *Sulphuric Acid:* *L*9. The Sulphuric Acid Industry in Japan. (Japan.) By Mototaro Matsui. *L*10. The Use of Nitrous Gases for the Intensive Manufacture of Sulphuric Acid. (U.S.S.R.) By Prof. V. N. Shulz. (*b*) *Phosphatic Fertilisers:* *L*11. Methods for the Production of Concentrated Fertilisers from Poor Phosphates. (U.S.S.R.) By E. Britzke and Prof. S. Volfkovich. (*c*) *Calcium Carbide:* *L*7. Granular Carbide and its Characteristics. (Japan.) By Katsuharu Hibi.

GROUP III.—BIOLOGICAL PROCESSES. (*a*) *Fermentation:* *L*1. Some Observations on theDesign of Apparatus and Heat Economy in the Fermentation Industry. (Austria.) By W. Vogelbusch. (See also *L*2 in § 1 above). (*b*) *Refrigeration:* *L*6. The Progress of the Frozen Food Industry in Japan. (Japan.) By Takeshi Murayama. (*c*) *Fumigation:* *L*3. Recent Advances in Fumigation and the Needs of Fumigation Practice. (Gt. Britain). By Prof. J. W. Munro.

The subject of water treatment is dealt with very comprehensively and from a variety of standpoints. With one exception (*L*2), which comprises a presentation of modern theories concerning the influence of the salts of brewing waters on the chemical processes of brewing and on the quality of the unfinished beer, the papers deal with the softening and conditioning of water for steam raising. The tendency towards higher pressures and steaming rates in modern boiler practice has necessitated considerable modification in the standard practice of water treatment as hitherto established for lower pressures. A notable feature of several of the papers is the emphasis laid on the need for a clear understanding of the fundamental principles underlying the processes of water softening and boiler feed-water conditioning, upon the clear appreciation of which principles the successful treatment of water for industrial use depends.

The papers by P. Hamer (*L*5) and L. O. Newton (*L*4) provide excellent general surveys, and, since each tends to emphasise different aspects of the subject, they are to a large extent complementary. Thus, the first paper (*L*5) is a discussion of the physical and chemical principles underlying water treatment, and stresses the necessity for applying methods of treatment in accordance with the laws governing the chemical

reactions involved, whilst the second ($L4$) is chiefly concerned with practice, and the practical effects of the various methods referred to are well illustrated by the many typical analyses quoted by the author.

The eliminaton of temporary hardness by lime treatment is referred to in $L4$, and is dealt with in detail by Professor C. Jacobson ($L2$), as applied to a large softening plant used for brewing water. This plant, which is automatic in principle, employs coarse marble powder to promote the conversion of the precipitated calcium carbonate to a less-dispersed crystalline form, thereby securing rapid sedimentation.

Under the lime-soda process and its various modifications ($L4$ and $L5$), are discussed the formation and flocculation of precipitates, time of settling, and the use of heat and, more particularly, coagulants as useful adjuncts in the removal of magnesium precipitates. Thus, the use of sodium aluminate as a coagulant is stated to result in a softened water of low hardness which is free from after-precipitation, and in an increase in economy of plant of 25 per cent. Reference is made to the effect of the presence of precipitate from a previous cycle in accelerating the rate of the softening reaction ($L2$ and $L5$). The base-exchange process, alone and in conjunction with lime-soda treatment, is described in some detail ($L4$). Reference is also made to the recent application of synthetic resins of an acid or basic character, whereby it is possible to remove the whole of the dissolved salts ($L4$). Further research on such materials is proceeding, the result of which will be awaited with interest.

## Removal of Oil from Feed Water

The removal of oil from feed-water, using aluminium hydroxide as coagulant, together with the alternative method of electrical coagulation, are briefly discussed ($L4$). The primary objects of any conditioning treatment for boiler feed-water are the prevention of hard-scale formation and embrittlement, and the reduction of corrosion to a minimum ($L4$ and $L5$). Recent studies on the mechanism of scale formation in boilers are discussed ($L5$), the most commonly occurring scales being composed of calcium sulphate and/or calcium carbonate. Work is described which shows how the $CO_3 : SO_4$ ratio varies with boiler pressure and under the influence of the soluble sodium salts usually found in boiler waters. The smaller critical values of the $CO_3 : SO_4$ ratio revealed by this work should make it possible to condition water with sodium carbonate for use at higher pressures than hitherto believed possible. This has not yet been demonstrated in practice. A description is given ($L4$) of the practice for high-pressure boilers fed with evaporator distillate and condensate, in which the feed is treated with a small quantity of caustic soda and sufficient sodium sulphate to counteract embrittlement, final conditioning being carried out with trisodium phosphate. A recent innovation is the use of sodium hexametaphosphate (under the name "Calgon"), which is marketed in the form of thin flakes, which are extremely soluble in water.

Reference is made ($L13$) to the difficulties encountered in the preparation of water for electric steam boilers, because the ordinary methods of softening are not permissible, the water being used as a resistance for heating purposes. Experience in this field is as yet very limited.

## Heavy Chemical Industry

The general development of the sulphuric acid industry in Japan is outlined by Mototarô Matsui ($L9$), and the capacities of the factories using different systems already in existence and projected are given. An estimate of production costs for nitration, concentration, and the contact system is made in relation to various methods of working. The paper by Professor V. N. Shulz ($L10$) deals more specifically with the intensification of the tower process for producing sulphuric acid in the U.S.S.R., and, in addition to describing new industrial forms of the intensive process, gives an iinteresting account of the research work which has been carried out, and which is still in progress, with a view to studying the kinetics of the individual stages of processes using nitrous gases.

Under the heading of raw materials, attention is directed ($L9$) to the increasing use of powdered ore in place of lump pyrites, and the recent use of the dust obtained from copper ores by oil flotation methods. The special technique required to secure the uniform burning of ores which comprise mixtures of iron pyrites and raw sulphur is also referred to, together with the use of electrolytic oxygen in admixture with the burner gases. Reference is made in both $L9$ and $L10$ to the chamber process, and the view is expressed ($L10$) that this process offers no prospects of further development.

A short description of the use of the tower process in Japan is given ($L9$), and investigations in the U.S.S.R. into the possibilities of development in this process are described in considerable detail (L10). These investigations have clearly demonstrated the possibility of increasing the intensity of production to obtain an output of 45 kg. and more of sulphuric acid calculated to 100 per cent. acid per cu. m. of volume of a tower system per 24 hr. Intensification of the tower process is attained mainly by regulating the composition of the furnace gas, and by modifications in the method of spraying the towers and in the temperature conditions.

## Phosphate Fertilisers

E. Britzke and Professor Volfkovich ($L11$) draw attention to the numerous deposits of low-grade phosphates, many of which occur in regions of intensive agriculture. The production of concentrated fertilisers from such materials is therefore an important economic factor in many countries. The concentration and utilisation of poor-quality phosphates has been the subject of much investigation in the U.S.S.R., and this work is described in considerable detail and in relation to work of a similar character in other countries. Amongst other things, the authors emphasise the need for a special study of concentration of the raw material by means of calcination, selective crushing, flotation, electro-magnetic and other methods, together with the further development of plants for the electro-thermal and blast-furnace treatment of phosphates, the production of metallurgical slags containing phosphorus, etc. They further advocate that attention should be directed to the co-ordination of fertiliser production with the fuel, metallurgical, nitrogen and other industries.

A process is described by Katsuharus Hibi ($L7$) which the author has developed for the production of porous granular carbide directly from the hot stream of molten carbide by atomising it with gas under high pressure. This product can be directly charged into a cyanamide furnace without further treatment, and gives equally good results as milled carbide. The speed of generation of acetylene is an important characteristic, and is stated to be very great compared with ordinary block carbide, so that the granular form is especially suited for pressure acetylene generators.

## Biological Processes

Professor C. Jacobsen ($L2$) deals with present-day theories regarding the influence of salts of brewing water on the chemical processes of brewing and on the quality of the finished beer. A distinction is made between "acidity-destroying" salts, particularly calcium carbonate, and "acid-promoting" salts such as calcium sulphate. A detailed description of some typical reactions between these salts and the mineral constituents of the malt is given, and attention is drawn to their influence on the hydrogen-ion concentration of the mash and the wort.

W. Vogelbusch ($L1$) describes the manufacture of compressed yeast by the aeration method, with particular reference to the aeration of the wort. The author discusses the economy in air consumption which can be effected by introducing the air in an extremely finely-divided state, and describes a form of apparatus in which this very fine diffusion of the air is effected mechanically by breaking up the bubbles as they are formed. Reference is made by the same author

to the freeing of yeast factory effluents of decomposable matter by biological methods, but such treatment is limited in its application since it is not capable of dealing with the potassium and sodium salts derived from the raw materials. Recent methods are described for concentrating the effluents from yeast factories which produce spirit as a by-product. The syrupy vinasse obtained as the product of concentration is calcined, and the residue incinerated to recover the potash, the waste gases from the furnace being utilised in a waste-heat boiler.

The history of the frozen food industry in Japan is described by Takeshi Murayama (*L*6), with special reference to the application of refrigeration and freezing processes to the preservation of marine products. The defects of the earlier air-cooled systems are discussed, and the improvements resulting from the introduction of quick-freezing plants using calcium chloride or salt brine. The directions in which research is required in this field are outlined.

Professor J. W. Munro (*L*3) gives a concise account of the general principles of fumigation, including the use of auxiliary fumigants, vacuum fumigation, distribution and dispersion of fumigant, and other relevant matters. The author expresses the view that the poor toxicity of fumigants at low temperatures has been insufficiently appreciated, and suggests that it should be accepted as a working principle that toxicity varies directly with rate of metabolism. The practical significance of this is that more attention should be given to increasing artificially the metabolic rate by raising the temperature either prior to or during fumigation. The rapid and even distribution of the fumigant is of the highest importance, and presents problems deserving the fullest consideration of the chemical engineer. It is indicated that fumigation under vacuum may not be so markedly better than that under normal pressure as to justify the increased cost involved.

## Points from the Discussion

Mr. E. A. ALLIOTT, speaking on recent advances in fumigation, said experience had shown that a reasonable degree of enhanced temperature helps fumigation, and that when the temperature falls too low there was less possibility of getting a good kill. There was a great deal of room for further research—although a great deal was already being undertaken—on the question of auxiliary fumigants, but it all depended, of course, on the fumigant being used and the particular insect that was being dealt with. In the case of apples, ethylene oxide had been used, but it was necessary when using that to have also some inert gas, and he doubted whether the English authorities would allow such a material as ethylene oxide to be used under any other conditions. On the question of vacuum fumigation, Mr. Alliott said he thought it was possible in this way to force the gases into the goods far more efficiently than when there were large open spaces between them when it was very difficult to be sure that the calculated concentrations were being effective. A German process was mentioned in one of the papers, but that system was now being marketed by an English firm.

Mr. P. PARRISH (South Metropolitan Gas Co.) said the combustion of spent oxide as such was sensibly more economical than its recovery as sulphur and its subsequent combustion in in that form. It cost at least £1 per ton to extract sulphur from spent oxide—a relatively high expenditure. So long as the combustion of spent oxide as such was demanded, so long would the nitration process as distinct from the contact one continue in this country. Economic conditions rendered such a course inevitable. Many controversial aspects were raised by Professor Shulz, and the most significant was the relative merits of the liquid phase system, as contrasted with the nitrose system, in tower systems provided with packing. For ten years he himself had worked to perfect the liquid phase system. The Gaillard-Parrish liquid phase system was manufacturing to-day 5 million tons of sulphuric acid per annum in various parts of the world. This system was appreciably cheaper to install than any nitrose system involving packed towers. In Sweden—at Landskrona—typical of acid plants in many parts of the world, they were producing 30 to 35 kilos of 50° Bé. acid per cu. m. per day. Turbo dispersers had been improved, concentric coolers for cooling the dispersed acid had been perfected, and a new pumping system—extraordinarily cheap—had been devised. The Gaillard-Parrish system combined cooling of the lead walls with a vigorous liquid phase reaction. While a packed tower might conceivably afford better surface contact between acid and gases, 50 per cent. The Gaillard-Parrish liquid phase system had revealed itself to be the only system that combined uniformly steady operation with a consistently low escape, compatible with a phenomenally low capital expenditure. Packed towers must obviously cost, in capital expenditure, more than twice that of void towers.

Mr. L. N. CLARK commented on the fact that very little work had been done on the question of the causes of silicate scale formation in comparison with the work done on calcium sulphate scale, for example. Perhaps the reason for that was obvious. Calcium sulphate scales could be prevented by the addition of sodium carbonate or phosphate, whilst in the case of silicate the composition of the scale was definitely indeterminate. On the other hand, some work had been done which seemed to indicate that the use of sodium aluminate might be extremely beneficial in certain cases.

## A Special Case of Water Treatment

Mr. G. W. HEWSON (London Power Co.) said there was a special case of water treatment which seemed worthy of discussion since its importance was increasing. That was the case where the steam was used entirely for power generation and none for process work, so that the condensed steam was returned to the boilers and the small make-up was supplied efficiently by evaporators working in conjunction with the main heat cycle. In this special case two problems arose. Firstly, treatment designed to reduce corrosion in economisers, feed lines, etc., to a minimum, and in the second place, treatment designed to prevent corrosion, caustic embrittlement and scale formation—brought about by condenser leakage—in boilers. The second problem was comparatively simple, but the position was complicated by the first problem, that of supplying water which would produce a minimum of corrosion in the economisers. All feed-water passed through the economisers so that any treatment designed to protect the economisers must apply to the whole of the feed-water and it must be continuous. He believed the day could not be far distant when economisers would no longer be installed for large-scale power generation. Their place would be taken by feed-water heaters supplied with steam bled from the turbines and by air heaters, larger than those now in use, designed to abstract additional heat from the flue gases and supply it to the combustion chamber. That time, however, had not yet come, and therefore the state of the water passing through the economisers must be considered. Practical experience indicated that a very high degree of de-aeration was by far the most important item in the treatment of feed-water which was wholly derived from condensers and evaporators. When this high degree of de-aeration was obtainable it should not be necessary to raise the *p*H of the water to a value which was now generally accepted as correct. The sulphate and phosphate treatments were simultaneously reduced from the high rates associated with the continuous addition of caustic soda to the minimum set by actual leakage from the condensers and were best given to each boiler individually and in accordance with frequent chemical analyses of its contents.

Dr. PAGE (Research Station, Slough), pointed out that for effective fumigation, the goods should be set properly with a reasonable space between each so that penetration and diffusion could take place sufficiently readily. The main engineering requirement was the provision of suitable vaporising plants of sufficiently large capacity suitable for highly inflammable liquids such as ethylene oxide.

# General Aspects of Chemical Engineering—Section M

By Professor W. M. CUMMING

*M1.* Formation of Monomolecular Films on Thin Foils of Metals annd Cellulose. (Austria.) By H. Mark and H. Motz. *M2.* Raw Materials for Chemical Manufacture and the Manufacture of Chemical Products in Canada. (Canada.) By A. W. G. Wilson. *M3.* Advances in Canada in the Realm of Chemical Engineering. (Canada.) By Prof. G. Stafford Whitby and F. Gordon Green. *M4.* Present State of the Standardisation of Chemical Apparatus and its Further Development. (Germany.) By Prof H. H. Franck. *M5.* Relation between Low-temperature Research and Colloid Chemistry. (Germany.) By F. F. Nord. *M6.* Practical Importance of Spectroscopic Micro-analysis. (Germany.) By Prof. W. Gerlach. *M7.* Optics in the Service of the Chemical Engineer. (Germany.) By F. Löwe. *M8.* Organisation of an Industrial Research Station. (Gt. Britain.) By A. E. Dunstan. *M10.* Place of Fundamental Research in an Industrial Research Organisation. (United States.) By C. M. A. Stine. *M12.* Research Institutes and Designing Establishments for Chemical Engineering in the U.S.S.R. (U.S.S.R.) By Prof. N. F. Juschkewitsch. *M13.* Public and Private Research Institutions Connected with Chemical Industry in Japan. (Japan.) By N. S. Kyoku.

The papers presented in this section can be classified conveniently under three distinct heads:—(a) Fundamental research; (b) applied research, including (c) chemical engineering, and (d) industrial development. Several papers describing the work of research organisations sponsored by private enterprise or by governments are included, some of which are worthy of careful study.

Professor Franck (*M4*) describes the attempts being made to standardise laboratory equipment, including glassware and acid-resisting stoneware, a paper which forms a useful introduction to the work of the Section. Whilst such standardisation of the tools of the research worker ensures uniformity of all simple pieces of equipment, and allows of simplification in design and assembly, it is doubtful whether this effort could be extended beyond the more routine equipment. Much more might be said in favour of the standardisation of industrial equipment with which the author also deals.

## Fundamental Research

The contribution by C. M. A. Stine (*M10*) gives a clear differentiation between fundamental and what is termed pioneering applied research, the distinction being one of purpose rather than of nature or quality. The primary importance of fundamental research is stressed as providing (a) a basis for future processes, (b) a logical approach to more complex practical problems, and (c) an assurance of continued leadership in quality and economy of production. Secondary factors are the creation of consulting specialists accessible to the applied research worker, and the strengthening of relations with the universities. The fundamental research work of the universities, however, cannot, for reasons stated, take the place of that carried on in the research organisations, although the relation between the two is admittedly very intimate. Fundamental research is not to be undertaken unless it can be sustained indefinitely through conditions of industrial depression. It is only to be undertaken as a long-range effort, and with sympathetic support.

Examples of this type of fundamental work are described by H. Mark and H. Motz (*M1*). They have studied the formation of mono-molecular films on thin metal foil and on cellulose, processes which are intimately connected with surface phenomena, and with corrosion problems. The kinetics of the formation of these layers has been subjected to mathematical analysis, and the results are discussed. Under this heading may also be mentioned the work by F. F. Nord (*M5*) on certain aspects of colloid chemistry, which has yielded results of importance with regard to enzyme activity.

Professor W. M. Cumming.

Two interesting papers on the applications of physical methods to fundamental research and to industrial chemistry call for special mention, that by Professor W. Gerlach on spectrographic micro-analysis, and by F. Löwe on various other optical methods. Professor Gerlach (*M6*) describes the development of spectroscopy in its applications to chemical problems, pointing out that the chief advantages of the spectral method are its rapidity of determination, and the fact that the material under examination is not destroyed. It is well known that traces of impurities in metals have a marked influence on the properties of those metals, particularly in shortening their useful life. The method described is specially useful for investigating local corrosion where chemical analysis could hardly be applied. The limits for the detection of an element are, with few exceptions, independent of the components present. The method is also applicable for determining homogeneity in a metal or alloy which cannot be revealed by chemical analysis, as is shown by some examples given by the author. Some quantitative methods are described, and although great advance has been made, and in particular by the author himself, many difficulties remain to which some attention is devoted. It is of interest to note that ceramic material and glazes can be subjected to analysis by this method.

The paper by F. Löwe (*M7*), discusses the general applications of optical methods in the examination of raw materials and finished products. The individual methods are well known, but the paper serves a useful purpose in bringing together for the benefit of the chemical engineer and industrial chemist, a collection of instruments which afford effective means for controlling many different types of chemical reaction.

## Applied Research

Mention must again be made of the paper (*M10*) by C. M. A. Stine in connection with applied research. He emphasises the important place of fundamental research in the organisation with which he is connected, and amply proves his thesis by many examples from results achieved within the past nine years. The subjects cover a wide field, including chemical engineerting. A. E. Dunstan (*M8*), deals with the personnel and organisation of an industrial research organisation, and stresses the importance of fundamental research as distinct from specific or industrial research. He discusses the mutual interdependence of routine analysis, semi-scale development, and research, and shows how such an organisation functions.

Professor N. F. Juschkewitsch (*M12*) deals with the development of the chemical industry in Russia since 1917, prior to which it was practically non-existent. It now ranks as one of the foremost in the world, and a large variety of products

*Continued on page 12 (after Metallurgical Section)*

*Continued from page 10 (before Metallurgical Section)*

is manufactured in increasing amount. The author stresses the importance of intensive research towards the rationalisation and improvement of existing processes. The various research organisations of the Soviet Union are described, firstly those connected with various scientific institutes and universities, in which representatives of the industry actively participate. The second group—branch institutes—comprise some twenty-five different industries, many of these, *e.g.*, the food industry, being represented by a large number of separate industries. These institutes, representing about 15,000 workers, draw up the initial plans and submit these with estimates to the corresponding departments of the Peoples Commissariats. Only a selection of the more urgent problems is made amongst those suggested by individual institutes, factories, trusts, and individuals. The main work of these branch institutes is to be of service to the designing organisations, and much of the work is tested on an industrial or semi-industrial scale. The third group of research institutes comprises central laboratories situated at the factories, which are mainly concerned with the control of production.

### Research Institutions in Japan

N. S. Kyoku (*M*13) deals with public and private research institutions connected with chemical industry in Japan. In this work the government has taken a prominent share. Realising the importance of the manufacturing industries, it founded the well-known universities in that country, beginning with Tokio in 1886. Furthermore, it established its own independent research institutions, and supported the research laboratories of certain private concerns, co-operating with them and publishing information of value to the industry.

Professor Juschkewitsch shows how chemical engineering is divided between the designing departments of the branch institutes and special designing institutes, some 15 of the latter being situated at important centres in the Soviet Union, and serving separate branches of the chemical industry. These branch organisations have close contact with the designers of power stations, water supplies, sewage systems, and housing. Some 4,000 engineers and technicians are employed.

The designing of chemical factories in the U.S.S.R. comprises three phases. The preliminary design has to prove the necessity of the new enterprise, and gives a rough estimate of the cost. A technical design follows which includes, *inter alia,* the design of the settlement for factory workers; this forms the basis for the design and construction of the work, and fixes the output and plant required, including power supply. Finally, a working design is prepared which includes essential detail. This centralisation of design for all chemical factories simplifies and cheapens manufacture and effects an enormous accumulation of experience with regard to problems of calculation and design.

### Developments in Canada

Professor G. S. Whitby and F. G. Green (*M*3) deal with the subject so far as developments in Canada are concerned. A general survey is given, special attention being drawn to recent advances in the realm of chemical engineering. The paper opens with an account of the progress made in the design and operation of power plant, including the automatically-controlled electric boiler, which has made possible the development of many industries in densely-populated areas far removed from local coal supplies. Mention is made of developments in the oil industry, including the treatment of lubricating oils and tar sands, and the installation of cracking units.

The pulp and paper industry is the largest employer of chemical engineers. It has established a research institute of its own to undertake fundamental research, which has given special attention to the recovery of by-products. In this connection, mention may be made of the installation of a multiple-effect evaporator comprising ten effects, with a total heating surface of 133,000 sq. ft. used for the recovery of alkali. The recovery of sulphur is also worthy of note, a Freeman flash roaster having been developed within recent years for burning pyrites, flotation residues, or sulphide concentrates.

The development of the metallurgical industries has been rendered possible by the hydro-electric plants on the Columbia river. A synthetic ammonia plant is another component of this organisation, the hydrogen being obtained by the electrolysis of water; and acetylene from calcium carbide now forms the basis of a series of important synthetic organic products. It is of interest to note that the silicon iron and nickel chrome steels used so extensively in these operations are now manufactured by the metallurgical industry of Canada.

### Industrial Development

In addition to the papers from Russia and Japan, Canada is represented by the paper bf A. W. G. Wilson (*M*2), in which he gives a survey of the raw materials available for manufacture in that country. The Dominion possesses extensive resources of mines, forests, and natural water power, whilst natural gas and fuel oil have made important contributions to her power resources. Many of the ores are exported as concentrates, or as refined metals. There are good supplies of minerals, such as asbestos, felspar, mica and pyrites. Of the organic products, cellulose is the most important, and owing to the abundance of pure water and cheap power, extensive development in primary cellulose production has taken place. Amongst the heavy chemicals, sulphuric, nitric, hydrochloric, sulphurous acids, alkalies, chlorine, and calcium carbide are important, while the manufacture of artificial abrasives, such as silicon carbide, is a long-established industry.

## C.A. Lawn Tennis Tournament

### Second Round Results

SINGLES

E. Pavitt (Co-operative Wholesale Society, Drug Works) beat F. Neason (Alfd. Herbert, Ltd.), 11—9, 3—6, 6—2.

E. A. Thomsett (The British Oxygen Co., Ltd.) beat J. H. W. Turner (Griffiths Bros. and Co. (London), Ltd.), 6—1, 6—2.

A. E. Hughes (Limmer and Trinidad Lake Asphalt Co., Ltd.) beat R. F. Welsh (The British Oxygen Co., Ltd.), 4—6, 6—1, 6—1.

C. G. Copp (Doulton and Co., Ltd.) beat F. G. Crosse (Society of Chemical Industry), 6—1, 6—1.

A. Tickner (British Celanese, Ltd.) beat R. D. Hayman (Doulton and Co., Ltd.), 7—9, 6—0, 10—8.

DOUBLES

P. D. O'Brien and F. D. Hand (B. Laporte, Ltd.) beat R. H. Champkin and C. J. Mucklestone (B. Laporte, Ltd.), 6—1, 6—1.

G. J. Brewer and A. W. A. Goudie (British Celanese, Ltd.) beat F. G. Crosse and J. E. Walker (Society of Chemical Industry), 6—2, 6—3.

G. C. Gough and T. P. Williams (Lever Bros., Ltd.) beat W. Speakman and S. E. Chaloner (Monsanto Chemicals, Ltd.) 6—3, 2—6, 6—2.

A. E. C. Willshere and L. F. Grape (Borax Consolidated, Ltd.) beat A. W. White and R. H. Hornsby (Howards and Sons, Ltd.), 6—2, 6—0.

R. D. Hayman and C. G. Copp (Doulton and Co., Ltd.) beat H. A. Steel and D.H. Jaffe (Society of Chemical Industry), 3—6, 6—3, 6—3.

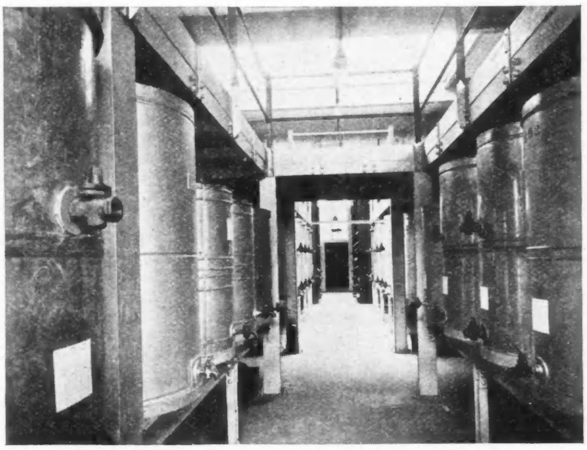
BELGIAN exports of precipitated phosphates during 1935 totalled 33,756 metric tons in contrast with 38,488 in 1934 and 28,946 in 1933. Chief markets served in 1935 were: France 9,835 tons; Netherlands 5,783; United States 4,508; United Kingdom 2,643; Germany 1,488, and Finland 1,398.

# Lacquer Manufacture at Smethwick

## The New Works of The Frederick Crane Chemical Co., Ltd.

JUST 49 years ago The Frederick Crane Chemical Co. commenced the manufacture of celluloid lacquers at a very small works in Newhall Hill, Birmingham. The task of selling these relatively highly priced finishes was, for many years, a very difficult one, but by 1912 sales necessitated a larger works. A new factory with ample space for expansion was built and fitted out at Bordesley Green, and here sales continued to increase steadily, the introduction of coloured pigmented enamels on a cellulose base giving a special fillip to production figures.

The general trade depression of 1931 and 1932 brought a slight moderation in the rate of sales increase, but by 1934, sales were leaping up again and it was very evident that a site for a new factory had to be found. Many possible sites in and near Birmingham were considered, and the present one was finally decided upon as fulfilling the company's requirements of size and central position with facilities for speedy distribution to all parts of Birmingham, the Midlands and the British Isles. It is considered that the new factory is the most perfect example of its type in the world, as from its inception it was planned solely for manufacturing lacquers, enamels and wood finishes for industrial requirements, and no attempt has been made to cater for the retail or household trade.



**A view of the lacquer storage tanks at the new works of the Frederick Crane Chemical Co., Ltd., at Smethwick**

This new factory comprises three main buildings, the office block, the thinners and solvent plant, and the main factory, and several smaller buildings such as the raw material stores, special mixing buildings, power house, laboratories, etc. There is nearly 75,000 square feet of factory flooring and 10,000 square feet of office space.

To provide adequate safeguards against injury to workers, and suspension of production on account of accidents, is an obvious necessity in any factory, but the fact that a large proportion of the firm's products contain inflammable materials, while certain of the constituents in the raw state present an explosion hazard, made it particularly important that every precaution should be taken against fire. The buildings themselves, floors, roofs, partitions, doors, platforms, trucks, tanks and all general equipment are made of fire resisting materials whilst, as an additional precaution, the departments of the main factory can be isolated by fireproof doors which close automatically if the temperature rises above normal. Automatic cut-outs are also arranged in the ventilating ducts. The nitro-cotton stores are isolated and subdivided, each section being provided with double safety exits and loose fitting skylight vents. The floors are lead-lined and workers, who must wear overshoes, use only non-ferrous appliances for handling the nitro-cotton.

Electric motors and fittings throughout the factory are of the explosion proof type and carry the Buxton Explosion Test Certificate. Switch gear is arranged outside the main buildings. Fire extinguishers of the carbon dioxide and foam type are distributed throughout the works and, as a final precaution, a special telephone line connects the works with the nearest fire station, and this line is tested twice each day.

The fact that the greater portion of the materials being produced are in liquid form enables very effective use to be made of pipe lines in arranging the manufacturing layout. Approximately 2½ miles of galvanised steam quality tube is used for transferring raw materials, intermediates and finished products, and by an ingenious use of gravity, with occasional assistance of special pumps, the greater part of the production calls for no mechanical or manual transfer of materials.

Solvents, of which some sixteen are used in considerable bulk, are mainly received in tank wagons. After a laboratory approval test the solvent is allowed to flow into the appropriate storage tank and from this a pump keeps a constant supply in the pipe lines conveying the material to various parts of the works where it is required. The solvents used in larger quantities are conveyed in 1½-inch pipes, while for the remainder 1-inch pipes are used. In the case of thinners, cleaning solvents, etc., the constituent liquids are run into the mixing drum and automatically weighed at the same time, the flow being cut off when the required weight has been added. The mixture then flows into a lower drum for thorough mixing by mechanical agitation and finally it flows into a storage tank from which it can be pumped through a measuring pump into containers of any size which may vary from 40-gallon drums to 1-pint cans.

The manufacture of clear solutions, comprising lacquers, wood finishes, bronze mediums and enamel bases, is naturally more complicated. A heavy solution is usually first prepared by measuring out the correct quantity of nitro-cotton, adding solvents, again measuring accurately and automatically by weight, and rotating the mixing drum mechanically whilst other solvents, plasticisers, etc., are added as called for on the formula. This heavy solution is then conveyed by electric lift to a higher platform and the remainder of the manufacture of the thinner clear solutions is ingeniously arranged to make best use of transfer by gravity. The final storage tanks are arranged on platforms on the ground floor level, and an overhead gangway runs the length of the factory so that finished materials can be trucked along to the storage tank and allowed to flow into the tanks. The storage tanks are arranged on platforms at a height from the floor which will allow any standard size container to be filled direct from the tap.

In preparing enamels containing pigments, grinding is a most important factor, and it is frequently necessary, when incorporating certain hard pigments, to run mills continuously night and day for several days to obtain the degree of pigment dispersion required.

Throughout these processes laboratory control is maintained in several ways. Firstly, all incoming raw materials must pass through searching laboratory tests before they are approved for use in the works, and special routines have been prepared for each material used according to the qualities it must show, thus ensuring that an enamel or lacquer that will be entirely satisfactory for its particular purpose. Secondly, the laboratory staff prepare the standard or recipe which provides instruction as to quantities to be used and exact details of the methods of incorporation and mixing.

This formulua also gives instructions for routine tests which are to be made in the course of manufacture, some of the tests being of a physical type such as a viscosity test, and others being of a practical nature such as tests for coverage or smoothness. Any deviation from the standards laid down are reported immediately to the laboratory and further action is taken on the special instructions received. Thirdly, samples are extracted from the materials in process of manufacture and are taken to the laboratory for more elaborate and accurate tests.

Finally, laboratory approval must the obtained before any quantity of a finished product is drawn from a fresh batch in storage, and in the case of large batches or materials for special work, this test may be repeated several times before the batch has all been exhausted.

A special department of the laboratory deals solely with the development of new processes of manufacture, the use of new raw materials, the production of new and interesting products, and new methods of application. The services of this department are always available to customers, and the company's chemists are constantly co-operating with the technical staffs of customers with the object of effecting the steady improvements in products which have been maintained since the company first introduced cellulose finishes.

# The John Benn Hostel Banquet

## A Message from the King

EMINENT figures in widely different walks of life—the Church, State, commerce, education, politics, and even the films—paid tribute to the social service which is being rendered by the John Benn Hostel for homeless boys in Stepney, at the tenth annual banquet of the East End Hostels Association held at the Stationers' Hall on June 25. A distinguished gathering was present and heard eloquent appraisement of the work of the East End Hostels Association, of which Sir Ernest Benn is president, by the Archbishop of Canterbury; Sir Campbell Stuart, treasurer of the King George Jubilee Trust; Mr. A. Ross Wallace, headmaster of Sherborne; Mr. George Arliss, the famous screen actor; and Sir Josiah Stamp, the economist, who occupied the chair.

The following message from the King, who has displayed the keenest interest in the activities of the Hostels Association, was read by the chairman: "The King thanks the friends and members of the East End Hostels Association for their loyal assurances, which his Majesty much appreciates. His Majesty, who retains pleasant recollections of his previous visits to the John Benn Hostel, sends his good wishes to the Association for the continued success of its work."

Mr. A. TOWNSHEND, warden of the John Benn Hostel, announced at the close of the banquet that promises of donations amounting to the record total of £1,758 15s. 6d. had been received that night. At the previous banquet £1,172 was subscribed by well-wishers.

Mr. A. ROSS WALLACE proposed the toast of "The Young Citizen." There was a number of pressing needs so far as the young citizen was concerned, he said, to which attention was drawn to-day. The first was the imperative necessity for greater interest in and development of physical training for young people. The second was training the young citizen in full and profitable occupation of his leisure hours; the third need was discipline; and the fourth, a sound religious foundation to his character.

Sir CAMPBELL STUART, who replied to the toast, said as treasurer of King George's Jubilee Trust he was glad to bear testimony to the admirable work which was being undertaken by the East End Hostels Association. The name of Benn was, he added, synonymous in London with public spirit.

The ARCHBISHOP OF CANTERBURY, who submitted the toast of "The East End Hostels Association," said he had first become aware of the East End of London, and all it stood for, as a young and ambitious politician at Oxford. He was proud to remember that the first meeting of undergraduates on behalf of settlements in the East End had been held in his own rooms at Balliol. On entering the Church his first work had been among the slums of Leeds—far worse slums at that time than any to be found in London to-day—and one of the first things he had done in Leeds had been to establish a hostel of his own for working boys, which he had managed and financed entirely out of his own resources. No better work could be done to-day than was being done by the John Benn Hostel, where admirable training was being given the young citizen. He hoped that hostels for boys on similar lines would be opened, not only in other parts of Londn, but in all parts of the country. In his judgment, the work of establishing new hostels was in the very forefront of the social needs of the times.

Sir JOSIAH STAMP, in response, said boys were fitted for the struggle of life at the John Benn Hostel. They were educated to co-ordinate their values, the confusion in their minds was straightened out, they were given right standards by which to judge life and their initiative was developed.

Sir ERNEST BENN, who also replied to the toast, was described by Sir Josiah Stamp as "the man who has put 'Benn' into benevolence." Sir Ernest said his special function was to guarantee to those who supported the Hostel that they would have good value for their money, and on that side of the work it could be expressed in one sentence—"Good, clean, self-respecting citizens at £100 apiece." That was what it worked out at if they looked into the Hostel reports. "We have delivered 400 of them," Sir Ernest declared, "and there are thousands more awaiting treatment."

Mr. GEORGE ARLISS gave the toast of "The Livery Companies of the City of London," and mentioned that his family for at least two hundred years had mostly been printers, publishers or stationers. The John Benn Hostel was saving the nation money, he asserted, by caring for youths in the early stages of their careers and supplying them with a sure foundation of mental and physical health.

Sir GEORGE BROADBRIDGE replied.

The chairman was toasted by Mr. WEDGWOOD BENN, who made one of the wittiest speeches of the evening.

# Finding New Uses for Glue

## Research to be Encouraged

A COMPETITION was held some time ago by the "Epidos" International Association of Bone Glue Manufacturers with the object of stimulating and rewarding research for the increase and improvement of outlets for bone glue. This competition aroused considerable interest among all kinds of research workers, and several promising ideas were put before the Association. A total sum of 30,000 Swiss francs was distributed to the winners of this competition.

The Epidos Association has decided to continue its investigations in this direction. It has set aside a certain sum for the purpose of encouraging research by those who will put forward interesting ideas for the use of glue, and also recompensing those with proposals already ripe for development.

The General Secretariat of the International Association, at 40 Rue du Colisée, Paris, is prepared to furnish all information to any person desirous of submitting a proposition for a new use or the improvement of an existing use for bone glue.

# Society of Chemical Industry

## Next Week's Meeting at Liverpool

FINAL details of the programme for the fifty-fifth annual meeting of the Society of Chemical Industry, to be held at Liverpool from Monday to Friday next week, reached us as we were going to press. The meeting will be presided over by Mr. W. A. S. Calder, and at the business meeting on Tuesday morning he will be succeeded by Lord Leverhulme, who has been nominated for the presidency for the ensuing year. Mr. J. S. Towers, secretary of the Liverpool section, is the hon. secretary of the meeting, the headquarters of which will be at the Adelphi Hotel. The programme is as follows:

MONDAY.

10 a.m. onwards.—Registration at Adelphi Hotel.

8 p.m.—Reception by the Vice-Chancellor of Liverpool University, Sir Hector J. W. Hetherington, Gilmour Hall, the University.

TUESDAY.

10 a.m.—Council meeting, Senate Room, the University.

10.45 a.m.—Annual general meeting, Physics Theatre, the University. Welcome by the Lord Mayor of Liverpool, Councillor R. J. Hall; annual business: president's address by Mr. W. A. S. Calder, "The Chemist as World Citizen."

10.30 a.m.—Ladies' visit to Liverpool Cathedral.

1 p.m.—Luncheon, by invitation of the Liverpool Section, Adelphi Hotel.

2.30 p.m.—Visit to the "Franconia," tea on board; group photograph.

8.30 p.m.—Civic reception, Town Hall, by invitation of the Lord Mayor.

WEDNESDAY.

9.30 a.m.—Road and Building Materials Group Session, Adelphi Hotel. Address by R. G. Batson, M.I.C.E., M.I.M.E., "Scientific Research and the Highway Engineer."

10 a.m.—Ladies' visit to Aintree biscuit factory of W. and R. Jacob and Co., Ltd.

11.30 a.m.—Presentation of Messel Medal to Sir Robert Mond; Messel Memorial Lecture by the medallist, "Works as I have seen them grow," Adelphi Hotel.

1 p.m.—Luncheon of the Road and Building Materials Group, Adelphi Hotel.

2.15 p.m.—Works visits: (a) Bowater's Mersey Paper Mills, Ltd.; (b) British Insulated Cables, Ltd.; (c) Lever Brothers' Factory, Port Sunlight; (d) The Stork Margarine Factory, Bromborough; (e) Pilkington Brothers, Ltd., St. Helens; (f) Tate and Lyle, Ltd.; (g) Ventilating and control stations of the Mersey Tunnel.

7 for 7.30 p.m.—Annual dinner, Adelphi Hotel.

THURSDAY.

10 a.m.—Plastics Group session, Technical College. Address by Dr. R. Houwink, "Synthetic Resins, their Formation, Properties and Possibilities."

10 a.m.—Food Group Congress with the Royal Sanitary Institute, Southport, presidential address by Dr. L. H. Lampitt. Discussion on "Food Package and the Consumer."

10 a.m.—Ladies' visits: (a) Howard Ford and Co., Ltd.; (b) Johnson Bros. (Dyers), Ltd.

1 p.m.—Luncheon, by invitation of I.C.I. (General Chemicals), Ltd., Adelphi Hotel.

1 p.m.—Luncheon for ladies, by invitation of the Liverpool Section, Adelphi Hotel.

7 p.m.—Leave Adelphi Hotel by motor-coach for Port Sunlight. 7.30 p.m. for 8 p.m.—Dinner, by invitation of Lever Brothers, Ltd., Hulme Hall, Port Sunlight.

FRIDAY.

9.30 a.m.—Visit to the Dolgarrog works of the Aluminium Corporation, Ltd., and the Dolgarrog power station of the North Wales Power Co., Ltd., via the Mersey Tunnel, Queensferry, Mold, Denbigh, to Bettws-y-coed, lunch 1 p.m. After lunch the party will proceed to Dolgarrog for the works visits. At 4 p.m. the party will leave for Llandudno, where tea will be provided. The return journey will start at 5.30 p.m., arriving in Liverpool at 8 p.m.

## Visits During Congress Week

### Overseas Members at Luton and Silvertown

ON the only two afternoons of the international Chemical Engineering Congress that were free from technical sessions some thirty or more visits were paid to works of chemical interest in and around London. Two parties visited Luton. One went to the works of B. Laporte, Ltd., and the other to the works of George Kent, Ltd. They were shown round and afterwards entertained to tea.

In the party of 24 which visited Laporte's were delegates from Great Britain, France, Germany, America, Poland, Canada, Hungary and Italy. They included representatives of Goodrich Tyres, Pilkington Glass, Manchester Oxide, the Aluminium Co. of America, Fraser of Dagenham, Dorset Cordite, I.G. Farbenindustrie of Germany, Kuhlman of France, and Montecattini of Italy. Among them were Professor Webster Jones, of the Carnegie Institute of Technology, Dr. A. Wilson, of the Bureau of Mines, Canada, and Dr. Martius and Dr. Freytag, who are connected with the Safety First movement in Germany. Those who acted as guides included Mr. L. P. O'Brien, Mr. J. Sutherland, Mr. I. E. Weber, directors of B. Laporte, Ltd., and Mr. J. Harnaman, works manager.

The production of titanium pigments had a special interest for the visitors. They saw also the manufacture of barium sulphide and the conversion of barium sulphide to barium carbonate. They saw the making of sodium sulphide crystal and sodium sulphide concentrated. The manufacture of barium monoxide from barium carbonate and the conversion of barium monoxide to barium peroxide was another process they watched with interest.

The visitors afterwards had refreshments in the company's mess room, and thanks were expressed to the company for their hospitality.

At the works of George Kent, Ltd., the party—ten in number—were received by Sir Walter Kent, managing director, Mr. Leslie Kent and Mr. R. E. Handford, directors. They made a rapid tour of the works.

The Kent Multelec *p*H recorder attracted a great deal of attention. It is built for industrial use and a high degree of efficiency and reliability is combined in its construction. It is made in single-point and multi-point form. In the single-point recorder a large capacity pen traces a continuous record and in the multi-point type, as many as six temperature records can be printed concurrently on the same chart, switching from one point to another every minute.

Another interesting phase was panel work, containing various instruments giving records of the operation of various parts of a plant, and by which means all the information necessary for the efficient running of a boiler or other plant is readily available for the operating engineers. Special interest was taken in the exhibition room, where, among other things, they saw the type of air flow transmitter as supplied for the measurement of ventilation of air in the Mersey tunnel.

The visitors were afterwards entertained to tea. Members of the party were Mr. H. A. Romp and Dr. W. R. Van Wijk, of Amsterdam Laboratory; Mr. S. Frisken, London; Dr. A. Key, Coventry; Mr. A. Saunders and Mr. A. E. Higgs, of Bristol; Professor J. J. Morgan, of Columbia University; Mr.

L. E. Westman, of Toronto; Mr. C. R. Sams, of London; and Mr. Y. Naito, Japan.

A number of those taking part in the Chemical Engineering Congress visited the factory of John Knight, Ltd., at Silvertown, where they inspected the manufacture of all types of soap and, briefly, the expression of oil from seed and the rendering of raw fat to produce tallow. On reaching the works, the visitors were received by members of the board. They saw the raw fat, previously collected from butchers' shops, restaurants, abattoirs, etc., cooked in 3-ton vessels under vacuum. After cooking, the tallow is run from the vessels into tanks and the residue, consisting of animal tissue, carried by means of elevators, into hydraulic presses, to be compressed into cakes, and used in the preparation of animal and poultry food. After inspecting the boiler house, the party proceeded to the crushing mills, where oil is pressed from cottonseed and linseed under hydraulic pressure.

In the soap boiling or "pan" room, the actual soap boiling process was seen carried out in pans varying in capacity from five to forty-five tons of finished soap, the total capacity of the pan room being five hundred tons per week. In the frame-room, the liquid soap is run into frames or cooling machines and solidified into blocks and slabs, this operation taking between four and five days in the case of the framed soap and three hours in the water cooler. The process of toilet soap manufacture was inspected, from the chipping of the slabs from the frame room, the drying in steam heated chambers, mixing with necessary ingredients, *e.g.*, perfume, etc., milling through steel rolls to incorporate the ingredients uniformly, through the plodding machines which consolidate the chips from the mills into bars, to the stage of automatic cutting into pieces.

Tea was served in the new Royal Primrose Hall, opened last October.

# Personal Notes

Mr. J. PARKE JACKSON has resigned his directorship of Salt Union, Ltd.

Lord TRENT is to open, on July 16, the new schools for juniors and infants in Hereford Road, Colwick Hill, Nottingham, which have been named after his father.

Dr. H. D. DAKIN, an old student of Leeds University, who is now in charge of the Medical Research Laboratory, New York, was the recipient of the honorary degree of Doctor of Law at a congregation of Leeds University on June 29.

Mr. W. ROGIE ANGUS, M.A., Ph.D., assistant lecturer at University College, London, has been appointed by the Council of the University College of North Wales to be Lecturer in Physical Chemistry.

Professor F. S. KIPPING, who has been Professor of Chemistry at Nottingham University College for thirty-five years and is shortly to retire, had the honorary degree of D.Sc. conferred upon him at a congregation of Leeds University on June 29.

Dr. H. J. PLENDERLEITH, of the British Museum Research Laboratory, has been appointed Professor of Chemistry of the Royal Academy in succession to Dr. A. P. Laurie, whose term of office has expired. The Professor of Chemistry gives six lectures at the Royal Academy, in October and November, and while these are primarily intended for the Royal Academy students, they are open, free, to students of other art schools and Royal Academy exhibitors of the year who may wish to attend.

Mr. R. B. WILLMOT, the British Trade Commissioner at Singapore, is in the United Kingdom on an official visit. Mr. Willmot will be available at the Department of Overseas Trade on July 6, 7, and 8, for the purpose of interviewing manufacturers and merchants interested in the export of United Kingdom goods to British Malaya (covering the Straits Settlements, Federated Malay States and the Unfederated Malay States), North Borneo, Sarawak and Brunei, after which he will commence a tour of a few of the more important centres in the provinces.

A BRONZE BUST of the late Mr. T. P. O'Connor, which has been placed on the facade of Chronicle House, Fleet Street, was unveiled by Lord Camrose on Tuesday in the presence of a distinguished company of journalists. The fund for the acquisition of the bust, which is the work of Mr. F. Doyle-Jones, was raised by the "Newspaper World." Sir Ernest Benn, on behalf of the "Newspaper World" and the subscribers, "handed over" the bust to the safe keeping of the proprietors of the "Star." The unveiling ceremony was followed by short speeches at the office of the "Daily Telegraph," with which journal "T.P." started his London journalistic career some 66 years ago.

Sir WILLIAM BULMER has died at Bradford at the age of 54. He was concerned with the Bulmer Rayon Co., which was afterwards absorbed by the British Acetate Silk Corporation.

Mr. D. P. CHAPPLE, Mr. F. C. CHISNELL and Mr. R. L. PRAIN have been appointed to the Board of the Anglo Metal Co., Ltd., as from June 26.

Mr. JOHN S. ALLEN, The Moorings, Thornley Park Avenue, Paisley, who died on June 11, and who was a director of several companies, including the Blackhall Paper Mills of William Macintyre, Junior and Co., Ltd., and William Wotherspoon, Ltd., Glenfield Starch Works, made a number of bequests to charitable institutions in Paisley and district.

# Continental Chemical Notes

## Poland

ETHYL CHLORIDE IS NOW BEING MADE by the Ergasta Works at Stargard, according to a Warsaw report (quoted in "Chemische Industrie."

## Norway

AN ENGLISH COMPANY is understood to be actively engaged in examining the molybdenum ore deposits in the vicinity of Knaben.

## Lithuania

AN ACETYLENE AND OXYGEN FACTORY with an annual capacity of 200,000 cubic metres oxygen has been built near Kovno by the Swedish concern, "Aga" Gas Accumulator Company.

## Russia

ON THE BASIS OF SYNTHETIC RUBBER, imitation buckskin is now being produced at the "Skorochod" factory. The material is used for shoe uppers to which the soles (of the same material) can be directly secured by vulcanisation.

## Finland

ERECTION OF A SULPHATE PULP FACTORY with an annual output capacity of 40,000 tons is planned at Aänekoski by the Aânekoski A.-G., which already operates sawmills, paper works and a box factory.

## Czechoslovakia

THE CZECHOSLOVAK Solo Match Co. made a net profit of 7.8 million crowns in 1935 (7.5 millions in 1934), and the same dividend as last year (12½ per cent.) has been distributed.

THE USTI (Aussig) Chemical Union made gross earnings last year of 89.1 million crowns, and net profits of 6.2 millions (5.7 millions in 1934), out of which a dividend of 10 per cent. as last year has been declared.

# From Week to Week

BOOTS ATHLETIC CLUB held its annual sports on June 27 on the club ground at Lady Bay, Nottingham. A large crowd attended.

THE LORD MAYOR of London, Sir Percy Vincent, and the sheriffs of London, were the guests of Commander Sir Charles Craven, chairman of the English Steel Corporation, at Sheffield on June 29.

FISON, PACKARD AND PRENTICE, LTD., chemical manufacturers, etc., have called a meeting for July 17, for the purpose of considering a resolution by which power will be given to the company to guarantee the capital and principal of, and dividends and interests on stocks, shares and securities of other companies.

THERE IS STILL A LARGE IMPORTATION into South Africa of many types of fertiliser. Experiments are being carried on by the Government agricultural schools, and certain private companies, into the suitability of superphosphates and a number of compound fertilisers for different types of South African soil. The data so yielded have been of definite value to the average South African farmer, who has not been slow to realise the value of such chemical aids to increased production.

NON-INFLAMMABLE RUBBER SOLUTION, such as that used by cyclists to mend tyres, contains trichlorethylene, and can emit invisible fumes which prove fatal. At Clerkenwell, on June 25, Henry Lynn and Co., Ltd., boot and shoe repairers, of Eagle Street, pleaded guilty to carrying on a fume process without the use of an efficient exhaust draught, and for carrying on such a process below the ground level. Defendants were fined a total of £15, with £1 1s. costs.

MR. D. OWEN EVANS, M.P., chairman of the Council of the Copper Development Association, who presided at the annual meeting on June 30, commented on the healthy state of the copper industry resulting from expanding consumption. In presenting the report and accounts he drew attention, among other things, to the wide and increasing use of copper for varied purposes in the building industry, such as copper tubing for water services, pipes, and for a number of newer applications.

THERMOSIL, shown at the British Chemical Plant Exhibition, is a ceramic material which is acid resisting and will withstand rapid temperature changes. In addition its high heat conductivity is an important characteristic. It is supplied by George Skey and Co., Ltd., who have sole manufacturing rights, and are desirous that firms interested in the use of vessels manufactured from this unique material should be afforded an opportunity of conducting their own trials, and with this object are prepared to submit pieces of the ware for such a purpose.

PRELIMINARY FIGURES indicate that the production of chemicals and allied products in Canada was valued at $116,351,015, at factory prices, in 1935. This total was higher than in any year since 1930. The production value of 1934 was $108,052,039. There were 740 establishments operating in 1935, giving employment to 18,804 workers with salaries and wages of $23,541,803. The improvement in 1935 was quite general, with eleven of the industries included in this group showing substantial advances and three with small declines.

A NEW COKING PLANT which has been built by the Barnsley Coking Co. to co-ordinate the coking interests of the Barnsley Main, Barrow and Wombwell Main Collieries was started on June 30, by Lady Serena James, wife of the Hon. Robert James, chairman of the directors of the Barrow Barnsley Main Collieries, Ltd. The new plant covers between 10 and 15 acres, and preparations for its erection were begun only 14 months ago. Mr. W. Hay, managing director of the Barnsley Coking Co., who was entirely responsible for the conception and the carrying out of the scheme, said they would carbonise 2,100 tons of coal a day, or 440,000 tons a year, at the new plant, getting 75 per cent. back as coke. For the remainder they would get 1,250,000 gallons of motor spirit, as well as tar, and sulphate of ammonia. They would also have 2,400,000,000 cubic feet of gas for sale.

THE PRODUCTION OF SALT IN SOUTH AFRICA is still less satisfactory than it might be. There are a number of inefficiently operated salt-pans, from which the products must improve if they are not to fall into disfavour. The better type of producer, however, seems to have gained a favourable reputation and his products are being purchased by consumers who have definite requirements. The production of salt either from sea water or from natural brine, the common process in South Africa, involves the process of fractional crystallisation, and the purity of the resultant product is somewhat dependent upon the care with which this is carried out. The importance of salt texture after refining is being emphasised; in crystallisation the size and form of the crystals depends upon the temperature, rate of evaporation, and concentration of the liquid. To eliminate lumpiness in table salt, and to keep the salt "free running," the producers are now adding small quantities of talc, magnesium carbonate or calcium phosphate. They are producing the best quality table salt by vacuum pan crystallisation.

THE TREASURY has made an Order under Section 10 (5) of the Finance Act, 1926, exempting kryofin from Key Industry Duty from July 3 until August 19.

DAMAGE ESTIMATED AT £8,000 TO £9,000 has been caused by fire at the Burnbank Chemical Works of William Forrest and Sons, Ltd., tallow and grease manufacturers, Fulbar Road, Paisley.

WALKER SOLUTIONS, LTD., manufacturers of preparations for heat resisting, etc., Pyrosol Works, Walnut Tree Road, Brentford, have increased their nominal capital by the addition of £1,500 in £1 shares beyond the registered capital of £2,400.

THE EXPANDING DEMAND FOR PIG IRON has necessitated the relighting of a fourth blast furnace at the Derbyshire works of the Staveley Coal and Iron Co. The work of relining and reconditioning the furnace has been in hand continuously since March, and the furnace will be relit on Monday. This will bring into full blast the entire battery of four furnaces. The third furnace was relit last year when trade was improving.

ON HIS ARRIVAL ABOARD THE QUEEN MARY at Southampton on Monday afternoon, Colonel Whiston A. Bristow, chairman and managing director of Low Temperature Carbonisation, Ltd., stated that while in America he had concluded an important agreement with a financial and engineering group for the development in the United States and Canada of the process for obtaining coalite, petrol and fuel oil from coal by low temperature carbonisation.

THE FIRST BATTERY OF THE COKE PLANT of Dorman Long and Co., Ltd., at Grangetown, Yorkshire, came into operation on Tuesday. The second battery will be ready later in the year and when the whole plant is working 20,000 tons of coal will be used weekly to make 13,000 tons of coke. The plant has been designed and built by Simon-Carves, Ltd., Cheadle Heath, Stockport, and each battery consists of 68 ovens of the underjet compound Otto twin-flue regenerative type, and is designed for heating by coke-oven or blast-furnace gas from the nearby blast-furnaces. The installation includes coal crushing and blending equipment, together with complete by-products plant; also coke screening and mechanical distribution to deliver coke by conveyor direct to the bins at the blast-furnaces. There is also a coke loading dock for distribution of coke by rail and for the conveyance of coke-oven gas by pipe line to the company's steelworks and mills. The plant when in full use will produce weekly 200 tons of sulphate of ammonia, 800 tons of crude tar and 70,000 gallons of crude benzol, and other substances.

# Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

## Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

STOCKTON CHEMICAL ENGINEERS AND RILEY BOILERS, LTD. (M., 4/7/36.) Registered June 22, series of £10,000 (not ex.) debentures, present issue £6,000; general charge. *£5,000. January 10, 1936.

## County Court Judgments

(NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court Judgments against him.)

GLENDENNING, Mr. J. M., By-pass Road, Billingham, works chemist. (C.C., 4/7/36.) £12 11s. 7d. May 30.

## Partnership Dissolved

HENRY P. STEVENS AND SON (Henry Potter Stevens, William Henry Stevens), consulting and analytical chemists, 15 Borough High Street, London, S.E.1, by mutual consent June 10, 1936. Debts received and paid by Henry Potter Stevens.

# Chemical and Allied Stocks and Shares

MOST sections of the stock and share markets have been less active this week, and chemical and kindred shares have reflected the general tendency to rather lower prices. There were, nevertheless, various individual features of interest, chief of which was perhaps a further upward movement in B. Laporte. Last year's 22½ per cent. dividend was a conservative payment and the view current in the market is that the company's business probably has scope for considerable further expansion. Imperial Chemical held up quite well and buyers were reported on any reaction, which is hardly surprising in view of the fact that on the basis of last year's 8 per cent. dividend the yield is over 4 per cent., or rather higher than that on many other prominent industrial shares. The rather larger yield offered by Imperial Chemical ordinary has to be read in relation to the indications given by the directors that a conservative policy is to be followed with a view tho further increasing reserves, etc. Until there is real improvement in the conditions for international trade, the dividend may, perhaps, be limited to 8 per cent. Greeff Chemicals Holdings 5s. ordinary shares were 3d. higher at 9s. Reference has been made here before to the good earning capacity of the business as shown by the prospectus figures and statements. The assumption in the market is that owing to the likelihood that demand for industrial chemicals will expand with improvement in trade conditions, the upward movement in the company's profits may be accelerated. Distillers were again an active feature. United Molasses were more prominent in sympathy. Estimates of the dividend vary a good deal in the market. It is generally agreed that profits are probably making a further step forward towards regaining the high level which ruled in the past; but in some quarters it is felt the directors may follow a conservative dividend policy until world trade conditions are more promising, although the fact that payment of an interim dividend has been resumed suggests that a good increase over last year's dividend is likely. In the past the company's profits have been around the £1,000,000 level. If this were regained in the future, high dividends would be possible on the ordinary shares, the amount of which was reduced by the drastic reconstruction of capital. Unilever continued steady on the improved outlook for the important West African undertakings of the group. International Nickel attracted attention on hopes in the market that a further increase in the quarterly dividend is likely. The shares fluctuated, largely owing to the fact that in common with most internationally-dealt-in shares, they tend to move closely with New York market conditions. Fison, Packard and Prentice have not been quotably affected at the time of writing by the statement as to the developments in connection with the important associated company in which the Imperial Smelting Corporation is also interested. The assumption in the market is that considerable expansion in the activities of this associated company is likely and that both Fison, Packard and Imperial Smelting may benefit a good deal. Imperial Smelting ordinary shares show little change at the time of writing, hopes having continued that despite the recent sharp reaction in the price of zinc, there are possibilities of the resumption of dividends with a small payment for the financial year ended June 30. British Glues have been firm on the past year's results which show a good increase in net profits from £71,471 to £86,841, and it would seem that the latter figure has been arrived at on a conservative basis. Hopes of the resumption of dividends on the ordinary shares are confirmed (preference dividend arrears were finally paid last year) with a payment of 7½ per cent., and the 8 per cent. preference shares receive an additional ½ per cent. on this occasion in view of their participating dividend rights. Reserves, etc., receive £30,000 and the carry forward is £35,308, compared with £36,217. Associated Portland Cement ordinary units received a good deal of attention on the belief that demand for cement is continuing to increase, bearing in mind the steps which are being taken by cement manufacturers generally to expand production facilities. Low Temperature Carbonisation were also active, following the news of plans for developing the company's process in America. Iron and steel shares were again in request although best prices were not held. Consett Iron benefited from the belief that the results for the past year, due shortly, will show further improvement in profits. It has already been officially indicated that the company expects to resume dividends for the current financial year. Oil shares were less prominent, but Anglo-Iranian, "Shell" and the other leading shares were aided by the favourable views of dividend prospects which continue in many quarters of the market.

| Name | June 30. | June 23. |
|---|---|---|
| Anglo-Iranian Oil Co., Ltd. Ord. | 81/10½ | 83/9 |
| Associated Dyers and Cleaners, Ltd. Ord. | 1/9 | 1/9 |
| **Associated Portland Cement Manufacturers, Ltd. Ord.** | 95/- | 94/4½ |
| ,, 5½% Cum. Pref. | • 27/6 | 27/6 |
| **Benzol & By-Products, Ltd. 6% Cum. Part. Pref.** | 6/10½ | 5/- |
| Berger (Lewis) & Sons, Ltd. Ord. | 68/1½ | 68/1½ |
| Bleachers' Association, Ltd. Ord. | 5/- | 5/- |
| **Boake, A., Roberts & Co., Ltd. 5% Pref. (Cum.)** | 19/4½ | 19/4½ |
| Boots Pure Drug Co., Ltd. Ord. (5/-) | 54/3 | 53/9 |
| Borax Consolidated, Ltd., Pfd. Ord. (£) | 110/- | 110/- |
| ,, Defd. Ord. | 28/4½ | 28/1½ |
| ,, 5½% Cum. Pref. (£10) | £12/2/6 | £12/2/6 |
| Bradford Dyers' Association, Ltd. Ord. | 7/6 | 7/6 |
| British Celanese, Ltd. 7% 1st Cum. Pfd. | 22/6 | 23/- |
| **British Cotton & Wool Dyers' Association Ltd. Ord. (5/-)** | 5/9 | 5/6 |
| British Cyanides Co., Ltd., Ord. (2/-) | 3/6 | 3/6 |
| **British Drug Houses, Ltd. Ord.** | 20/- | 20/- |
| ,, 5% Cum. Pref. | 22/6 | 22/6 |
| **British Glues and Chemicals, Ltd. Ord. (4/-)** | 9/- | 8/6 |
| ,, 8% Pref. (Cum. and Part.) | 30/7½ | 30/- |
| **British Oil and Cake Mills, Ltd. Cum. Pfd. Ord.** | 49/- | 49/- |
| British Oxygen Co., Ltd. Ord. | 107/6 | 102/6 |
| ,, 6½% Cum. Pref. | 33/9 | 33/9 |
| **British Portland Cement Manufacturers, Ltd. Ord.** | 97/6 | 96/3 |
| Bryant & May, Ltd. Pref. | 67/6 | 67/6 |
| Burt, Boulton & Haywood, Ltd. Ord. | 21/3 | 21/3 |
| ,, 7% Cum. Pref. | 28/1½ | 28/1½ |
| ,, 6% 1st Mort Deb. Red. (£100) | £101/10/- | £101/10/- |
| **Bush, W. J., & Co., Ltd. 5% Cum. Pref. (£5)** | 110/- | 110/- |
| ,, 4% 1st Mort. Deb. Red. (£100) | £94/10/- | £94/10/- |
| Calico Printers' Association, Ltd. Ord. | 6/10½ | 6/10½ |
| Cellulose Acetate Silk Co., Ltd. Ord. | 12/2 | 12/10 |
| Consett Iron Co., Ltd. Ord. | 11/10½ | 11/3 |
| Cooper, McDougall & Robertson, Ltd. Ord. | 32/6 | 32/6 |
| ,, 7% Cum. Pref. | 28/9 | 28/9 |
| Courtaulds, Ltd. Ord. | 51/10½ | 50/7½ |
| **Crosfield, Joseph, & Sons, Ltd. 5% Cum. Pre-Pref.** | 25/- | 25/- |
| Distillers Co., Ltd. Ord. | 103/3 | 105/6 |
| ,, 6% Pref. Stock Cum. | 31/6 | 31/6 |
| Dorman Long & Co., Ltd. Ord. | 35/- | 36/3 |
| **English Velvet & Cord Dyers' Association Ltd. Ord.** | 3/9 | 3/9 |
| Fison, Packard & Prentice, Ltd. Ord. | 44/4½ | 44/4½ |
| ,, 7% Non-Cum. Pref. | 31/3 | 31/3 |
| ,, 4½% Debs. (Reg.) Red. (£100) | £105/10/- | £106 |
| Gas Light and Coke Co. | 28/3 | 28/3 |
| ,, 4% Consolidated Pref. Stock (£100) | £107 | £106/10/- |
| Goodlass Wall & Lead Industries, Ltd. Ord. (10/-) | 12/6 | 12/6 |
| ,, 7% Prefd. Ord. (10/-) | 13/1½ | 13/1½ |
| ,, 7% Cum. Pref. | 28/9 | 28/9 |
| Gossage, William, & Sons, Ltd. 6½% Cum. Pref. | 24/4½ | 24/4½ |
| Imperial Chemical Industries, Ltd. Ord. | 38/10½ | 39/- |
| ,, Deferred (10/-) | 9/4½ | 9/4½ |
| ,, 7% Cum. Pref. | 34/6 | 34/7½ |
| Imperial Smelting Corporation, Ltd. Ord. | 16/3 | 16/3 |
| International Nickel Co. of Canada, Ltd. | $49¼ | $50¼ |
| **Johnson, Matthey & Co., Ltd. 5% Cum. Pref. (£5)** | 105/- | 105/- |
| Laporte, B., Ltd. Ord. | 121/3 | 118/9 |
| Lawes Chemical Co., Ltd. Ord. (10/-) | 8/1½ | 8/1½ |
| **,, 7% Non-Cum. Part Pref. (10/-)** | 10/- | 10/- |
| Lever Bros., Ltd. 7% Cum. Pref. | 33/3 | 33/3 |
| Magadi Soda Co., Ltd. 6% 2nd Pref. (5/-) | 6d. | 6d. |
| ,, 6% 1st Debs. (Reg.) | £30 | £33 |
| **Major & Co., Ltd. Ord. (5/-)** | 7½d. | 7½d. |
| **,, 8% Part. Prefd. Ord. (10/-)** | 9d. | 9d. |
| **,, 7½% Cum. Pref.** | 1/6¾ | 1/6¾ |
| Pinchin, Johnson & Co., Ltd. Ord. (10/-) | 47/6 | 48/- |
| Potash Syndicate of Germany 7% Gld. Ln. Sr. "A" and "B" Rd. | £80 | £80 |
| **Reckitt & Sons, Ltd. Ord.** | 115/- | 115/- |
| Salt Union, Ltd. Ord. | 42/6 | 42/6 |
| ,, Pref. | 47/6 | 47/6 |
| South Metropolitan Gas Co. Ord. (£100) | £124/10/- | £124/10/- |
| Staveley Coal and Iron Co., Ltd. Ord. | 55/7½ | 55/- |
| Stevenson & Howell, Ltd. 6½% Cum. Pref. | 26/9 | 26/3 |
| Triplex Safety Glass Co., Ltd. Ord. (10/-) | 93/9 | 95/- |
| Unilever, Ltd. Ord. | 33/9 | 33/9 |
| **United Glass Bottle Manufacturers, Ltd. Ord.** | 43/6 | 43/6 |
| United Molasses Co., Ltd. Ord. (6/8) | 25/- | 25/- |
| **United Premier Oil & Cake Co., Ltd. Ord. (5/-)** | 10/6 | 10/- |

# Inventions in the Chemical Industry

**THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.**

## Specifications Open to Public Inspection

THERAPEUTIC PREPARATIONS liberating carbonic acid, method for manufacture.—J. G. Waldenmeyer. Dec. 18, 1934. 20136/35.

ORTHO-OXYAZO DYESTUFF, manufacture.—I. G. Farbenindustrie. Dec. 18, 1934. 26316/35.

HALOGENERATED PHENANTHROLINES, process for preparing.—Naamlooze Vennootschap Nederlandsche Kininefabriek. Dec. 22, 1934. 27268/35.

AZO DYESTUFFS, manufacture.—I. G. Farbenindustrie. Dec. 21, 1934. 27976/35.

BARIUM SOAPS, production and use.—C. Deguide. Dec. 21, 1934. 28926/35.

ALKENES OR ALKENE MIXTURES in a pure or substantially pure condition, process for the production.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Dec. 21, 1934. 32503/35.

AZO DYESTUFFS CONTAINING CHROMIUM, manufacture.—Soc. of Chemical Industry in Basle. Dec. 18, 1934. 34648-9/35.

RUBBER-LIKE CHLORO-2-BUTADIENE-1, 3 POLYMER compositions.—United States Rubber Co. Dec. 22, 1934. 34967/35.

OXYGENERATED ALIPHATIC COMPOUNDS, preparation.—Carbide and Carbon Chemicals Corporation. Dec. 20, 1934. 35069/35.

AZO DYESTUFFS, manufacture.—Soc. Anon. des Matieres Colorantes et Produits Chimiques de St.-Denis and R. Lantz. Dec. 22, 1934. 35118/35.

METHOD OF SEPARATING the components of a mixture of salts.—I. G. Farbenindustrie. Dec. 22, 1934. 35574/35.

REMOVING BISMUTH from copper or copper-containing melts and products, process.—O. Nielson, and E. R. Lauber. Dec. 21, 1934. 35618/35.

CONDENSATION REACTIONS.—Deutsche Hydrierwerke, A.-G. Dec. 22, 1934. 35636/35.

## Specifications Accepted with Date of Application

MEDIUM FOR DETECTING CHEMICALLY reactive gases or vapours in air or other neutral gases.—B. Dräger, and O. H. Dräger. Sept. 11, 1934. 448,847.

CHLORO-DERIVATIVES of aromatic isoalkyl hydrocarbons.—K. Jülicher. Oct. 10, 1934. 448,851.

ANTHRAQUINONE DYESTUFFS.—Imperial Chemical Industries, Ltd., N. H. Haddock, F. Lodge, and C. H. Lumsden. Nov. 14, 1934. 449,010.

ANTHRAQUINONE DYESTUFFS.—Imperial Chemical Industries, Ltd., N. H. Haddock, F. Lodge, and C. H. Lumsden. Nov. 14, 1934. 449,011.

ANTHRAQUINONE DYESTUFFS.—Imperial Chemical Industries, Ltd., N. H. Haddock, F. Lodge, and C. H. Lumsden. Nov. 14, 1934. 449,012.

PRODUCTION OF FUEL.—Ruhrchemie, A.-G. Dec. 9, 1933. 449,013.

WASHING, WETTING, EMULSIFYING, AND LIKE AGENTS, manufacture and production.—Coutts and Co., and F. Johnson (Legal representatives of J. Y. Johnson (deceased) ). (I. G. Farbenindustrie.) Dec. 10, 1934. 449,081.

SOAPS AND SOAP MASSES, process for manufacturing.—Inzersdorfer Chemische Industrie Ges. Dec. 14, 1933. 448,930.

ACETALDEHYDE FROM ACETYLENE containing hydrogen, manufacture and production.—Coutts and Co., and F. Johnson (Legal representatives of J. Y. Johnson (deceased) ). (I. G. Farbenindustrie). Dec. 13, 1934. 448,871.

AROMATIC OR HETEROCYCLIC CARBOXYLIC ACID AMIDES of high molecular weight, manufacture and production.—Coutts and Co., and F. Johnson (Legal representatives of J. Y. Johnson (deceased) ). (I. G. Farbenindustrie). Dec. 13, 1934. 448,788.

AZO DYESTUFFS and metal compounds thereof, manufacture.—I. G. Farbenindustrie. Dec. 13, 1933. 448,872.

PRODUCTION OF ICE.—A. Carpmael (I. G. Farbenindustrie). Dec. 13, 1934. 448,873.

GUANYL AND BIGUANYL COMPOUNDS, process for the manufacture.—I. G. Farbenindustrie. Dec. 16, 1933. 448,796.

FLAVOURING MATTERS obtained from butter fat and their application.—Imperial Chemical Industries, Ltd. Dec. 16, 1933. 448,800.

POLYMETHINE DYESTUFFS, manufacture.—I. G. Farbenindustrie. Dec. 16, 1933. 448,936.

PACKING FOR PHOTOGRAPHIC plates.—I. G. Farbenindustrie. Dec. 20, 1933. 448,937.

CELLULOSE NITRATE, treatment.—E. I. du Pont de Nemours and Co. Dec. 16, 1933. 448,938.

CRYSTALLINE COMPOSITIONS containing chromium oxide, production of.—Carborundum Co. Dec. 18, 1933. 448,941.

CRYSTALLINE COMPOSITIONS containing chromium oxide, production of.—Carborundum Co. Dec. 20, 1933. 448,942.

LIGHT-METAL ALLOYS containing magnesium, heat treatment.—I. G. Farbenindustrie. Dec. 23, 1933. 448,944.

PAPER CONTAINERS, wrappers, or the like.—Imperial Chemical Industries, Ltd. Dec. 19, 1933. 449,026.

MANUFACTURE OF LEATHER.—A. Carpmael (I. G. Farbenindustrie). Dec. 18, 1934. 449,027.

SULPHONATED PRODUCTS, production.—A. Beyer. Dec. 18, 1933. 448,804.

AZO DYESTUFFS, manufacture.—I. G. Farbenindustrie. Dec. 19, 1933. 449,089.

## Applications for Patents

**(June 18 to 24 inclusive.)**

DIAZO COMPOUNDS, production.—Bleacher's Association, Ltd., and C. L. Wall. 17255.

ESTERS, manufacture.—A. G. Bloxam (Soc. of Chemical Industry in Basle). 17541.

COMPOUNDS OF THE PREGNANE SERIES, manufacture.—A. G. Bloxam (Soc. of Chemical Industry in Basle). 17542.

ABSORPTION PROCESSES.—Carbo-Norit-Union Verwaltungs-Ges. (Germany, June 24, '35.) 17023.

INDIGOID DYESTUFFS, manufacture.—A. Carpmael (I. G. Farbenindustrie). 17578.

TRANSFORMATION PRODUCTS of dystuffs, manufacture.—A. Carpmael (I. G. Farbenindustrie). 17579.

COAL-OIL MIXTURES, carbonisation.—Coal and Allied Industries, Ltd., and G. A. Wheatley. 17560.

COLLOIDAL COPPER COMPOUND.—R. V. Craven, W. J. Craven and W. J. Craven and Co., Ltd., 17183.

UNSATURATED ALCOHOLS, ETC., manufacture.—W. W. Groves. (Switzerland, June 18, '35.) 16967. (Switzerland, Sept. 4, '35.) 16968, 16969. (Switzerland, Feb. 12.) 16970.

PRINTING WITH VAT DYESTUFFS, process.—I. G. Farbenindustrie. 17222.

ANTHRAQUINONE DYESTUFFS, manufacture.—R. N. Heslop, Imperial Chemical Industries, Ltd., and W. W. Tatum. 17441.

ESTERS OF SALICYLIC ACID, manufacture.—Howard and Sons, Ltd., and W. E. Huggett. 17543.

PHOTO-LUMINESCENT GLASS, manufacture.—I. G. Farbenindustrie. (Germany, June 18, '35.) 16971.

MEANS FOR HARDENING IRON ALLOYS.—I. G. Farbenindustrie. (Germany), June 19, '35.) 16972.

ACETYLENE FROM CALCIUM CARBIDE and water, production.—I. G. Farbenindustrie. (Germany, June 22, '35.) 17081.

APPARATUS FOR MEASURING Rontgen rays.—I. G. Farbenindustrie. (Germany, June 20, '35.) 17082.

NITROGENEOUS CONDENSATION PRODUCTS of the anthrone series, manufacture.—I. G. Farbenindustrie. (Germany, June 27, '35.) 17583.

DYEING AND PRINTING CELLULOSE ESTERS AND ETHERS.—G. W. Johnson (I. G. Farbenindustrie). 17311.

# Chemical Trade Inquiries

**The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).**

**Australia.**—A firm of manufacturers' agents and importers wishes to obtain the representation of United Kingdom manufacturers of steam and water valves for the whole of Australia. (Ref. No. 1.)

**British India.**—The Director-General, India Store Department, Belvedere Road, Lambeth, London, S.E.1, invites tenders for 16,220 gallons cresol saponified, not B.P. or Lysol. Samples required with tender. Tenders due July 17, 1936. Forms of tender obtainable from the above at a fee (which will not be returned) of 5s.

**British India.**—H.M. Trade Commissioner at Calcutta reports that the Indian Stores Department is calling for tenders, to be presented in Simla by August 4, 1936, for the supply and delivery of steam raising plant. (Ref. T.Y. 30396.)

**South Africa.**—H.M. Trade Commissioner at Johannesburg reports that the South African Railways and Harbours (Stores Department) are calling for tenders for the supply and delivery of raw and boiled linseed oil, to be presented in Johannesburg by August 4, 1936. (Ref. T.Y. 40118.)

**Portugal.**—An agent established at Oporto wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of aniline dyes. (Ref. No. 13.)

**Argentina.**—The Commercial Counsellor to H.M. Embassy at Buenos Aires reports that the Argentine State Railways are calling for tenders, to be presented in Buenos Aires by August 6, 1936, for the supply and delivery of seamless copper tubes of various sizes. (Ref. T.Y. 30404.)

# Weekly Prices of British Chemical Products

THE following list of current chemical market prices is based on information specially gathered from a number of the principal suppliers in Great Britain generally and in London, Manchester and Glasgow in particular. In consequence of complaints that certain chemical products were unobtainable at prices quoted in a recent issue of THE CHEMICAL AGE the quotations printed below have been completely overhauled. At the same time we shall welcome any criticism of the present list in order that we may leave no stone unturned in presenting a reliable list of current prices each week. It should be remembered that unless otherwise stated the prices given cover fair quantities, net and naked at sellers' works, and that it may often be necessary to pay a considerably higher price than that quoted if only very small quantities are required.

MANCHESTER.—Steady price conditions continue in force almost throughout the range of products on the Manchester chemical market and buyers in the majority of instances have shown no hesitation in renewing contracts over the second half of the year. New business here during the past week has not been extensive and, apart from a sprinkling of fresh orders for forward delivery, has consisted largely of spot or near transactions. Deliveries against commitments have been adversely affected to some extent by the incidence of the annual holiday stoppages in one or two Lancashire industrial areas and this influence may be expected to grow during the next two months. Otherwise, the movement of chemicals into consumption locally is being satisfactorily maintained. In the by-products market a feature has been the renewed firmness in crude carbolic.

SCOTLAND.—Business in general chemicals for home trade has been rather quiet during the week, on account of the approach of stocktaking and holiday periods, and export business also has been rather limited. Prices generally continue quite steady at about previous figures with only slight changes to report.

## Price Changes

**Coal Tar Products.**—ACID, CRESYLIC, 97/99, 2s. 6d. to 2s. 7d. per gal.; pale, 98%, 2s. 9d. to 2s. 10d. per gal.; dark, 2s. to 2s. 1d. per gal. NAPHTHA, solvent, 95/160, 1s. 8d. per gal. PITCH, medium, soft, 36s. to 37s. per ton. TOLUOLE, 90%, 2s. per gal.; pure, 2s. 4d. to 2s. 5d. per gal.

**Pharmaceutical and Photographic Materials.**—ACID, ACETYL SALICYLIC, 2s. 7d. to 2s. 9d. per lb. ACID, SALICYLIC, B.P., 1s. 6d. to 1s. 9d. per lb.

## General Chemicals

ACETONE.—LONDON: £62 to £65 per ton; SCOTLAND. £64 to £65 ex wharf, according to quantity.

ACID, ACETIC.—40% technical. £16 12s. 6d. per ton. LONDON: Tech., 80%, £30 5s. to £32 5s. per ton; pure 80%, £32 5s. to £34 5s.; tech., 40%, £16 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £32 5s.; tech., 80%, £30 5s., d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £48 to £50.

ACID, BORIC.—Commercial granulated, £27 per ton; crystal, £28; powdered, £29; extra finely powdered, £31; packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. B.P. cryst., £36; B.P. powder, £37. SCOTLAND: Crystals, £28; powdered, £29.

ACID, CHROMIC.—Flaked, 10d. per lb., less 2½%; ground, 10¼d. per lb., less 2½%, d/d U.K.

ACID, CITRIC.—1s. per lb. MANCHESTER: 1s. SCOTLAND: B.P. crystals, 1s. per lb. less 5%.

ACID, CRESYLIC.—97/100%, 1s. 5d. to 1s. 6d. per gal.; 99/100%, refined, 1s. 9d. to 1s. 10d. per gal. LONDON: 98/100%, 1s. 5d. f.o.r.; dark, 1s.

ACID, FORMIC.—LONDON: £42 to £47 per ton.

ACID, HYDROCHLORIC.—Spot, 4s. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £18 to £25 per ton makers' works. SCOTLAND: 80°, £24 ex station full truck loads.

ACID, OXALIC.—LONDON: £47 17s. 6d. to £57 10s. per ton, according to packages and position. SCOTLAND: 98/100%, £48 to £50 ex store. MANCHESTER: £49 to £55 ex store.

ACID, SULPHURIC.—SCOTLAND: 144° quality. £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—1s. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. LONDON: 11½d., less 5%. SCOTLAND: 11¾d. less 5%. MANCHESTER: 11¾d. to 1s. per lb.

ALUM.—SCOTLAND: Ground, £10 2s. 6d. per ton; lump, £9 12s. 6d.

ALUMINA SULPHATE.—LONDON: £7 10s. to £8 per ton. SCOTLAND: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE.—SCOTLAND: Lump, £30 per ton; powdered, £33, in 5-cwt. casks d/d buyers' premises U.K.

AMMONIUM CHLORIDE.—LONDON: Fine white crystals, £18 to £19. (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

AMMONIUM SULPHATE.—Neutral quality, 20.6% nitrogen, £7 per ton.

ANTIMONY OXIDE.—SCOTLAND: £61 to £65 per ton, c.i.f. U.K. ports.

ANTIMONY SULPHIDE.—Golden, 6½d. to 1s. 1d. per lb.; crimson, 1s. 5½d. to 1s. 7d. per lb., according to quality.

ARSENIC.—LONDON: £13 10s. per ton c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r. mines. SCOTLAND: White powdered, £18 ex store. MANCHESTER: White powdered Cornish £21, ex store.

ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.

BARIUM CHLORIDE.—LONDON: £10 10s. per ton. SCOTLAND: £10 10s. to £10 15s.

BARYTES.—£6 10s. to £8 per ton.

BISULPHITE OF LIME.—£6 10s. per ton f.o.r. London.

BLEACHING POWDER.—Spot, 35/37%, £7 19s. per ton d/d station in casks, special terms for contract. SCOTLAND: £9.

BORAX, COMMERCIAL.—Granulated, £14 10s. per ton; crystal, £15 10s.; powdered, £16; finely powdered, £17; packed in 1-cwt. bags, carriage paid home to buyer's premises within the United Kingdom in 1-ton lots. SCOTLAND: Granulated, £14 10s. per ton in 1 cwt. bags; crystals, £28; powder, £29.

CADMIUM SULPHIDE.—4s. to 4s. 3d. per lb.

CALCIUM CHLORIDE.—Solid 70/75% spot, £5 5s. per ton d/d station in drums. SCOTLAND: £5 10s. per ton net ex store.

CARBON BISULPHIDE.—£31 to £33 per ton, drums extra.

CARBON BLACK.—3¾d. to 4¾d. per lb. LONDON: 4½d. to 5d.

CARBON TETRACHLORIDE.—SCOTLAND: £41 to £43 per ton, drums extra.

CHROMIUM OXIDE.—10¾d. per lb., according to quantity d/d U.K.; green, 1s. 2d. per lb.

CHROMETAN.—Crystals, 2⅝d. per lb.; liquor, £19 10s. per ton d/d

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r. or ex works.

CREAM OF TARTAR.—£3 19s. per cwt. less 2½%. LONDON: £3 17s. per cwt. SCOTLAND: £3 18s. net.

DINITROTOLUENE.—66/68° C., 9d. per lb.

DIPHENYLGUANIDINE.—2s. 2d. per lb.

FORMALDEHYDE.—LONDON: £24 10s. per ton. SCOTLAND: 40%, £25 to £28 ex store.

IODINE.—Resublimed B.P., 6s. 3d. to 8s. 4d. per lb.

LAMPBLACK.—£28 to £30 per ton.

LEAD ACETATE.—LONDON: White, £33 15s. per ton; brown, £1 per ton less. SCOTLAND: White crystals, £34 to £35; brown, £1 per ton less. MANCHESTER: White, £34, brown £33.

LEAD NITRATE.—£32 10s. to £34 10s. per ton.

LEAD, RED.—SCOTLAND: £31 per ton less 2½%; d/d buyer's works.

LEAD, WHITE.—SCOTLAND: £39 per ton, carriage paid. LONDON: £41.

LITHOPONE.—30%, £16 5s. to £16 10s. per ton.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

MAGNESIUM CHLORIDE.—SCOTLAND: £6 17s. 6d. per ton.

MAGNESIUM SULPHATE.—Commercial, £5 per ton, ex wharf.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

PHENOL.—6¾d. to 7½d. per lb.

POTASH, CAUSTIC.—LONDON: £42 per ton. MANCHESTER: £38.

POTASSIUM BICHROMATE.—Crystals and Granular, 5d. per lb. less 5%, d/d U.K. Ground, 5½d. LONDON: 5d. per lb. less 5%, with discounts for contracts. SCOTLAND: 5d. per lb. less 5% carriage paid. MANCHESTER: 5d.

POTASSIUM CHLORATE.—LONDON: £37 to £40 per ton. SCOTLAND: 99¾/100%, powder, £37. MANCHESTER: £38.

POTASSIUM CHROMATE.—6½d. per lb. d/d U.K.

POTASSIUM IODIDE.—B.P., 5s. 2d. per lb.

POTASSIUM NITRATE.—SCOTLAND: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 8¼d. per lb. SCOTLAND: B.P. crystals, 8¾d. MANCHESTER: B.P., 11½d.

POTASSIUM PRUSSIATE.—LONDON: Yellow, 7½d. to 8d. per lb. SCOTLAND: 7½d. net, ex store. MANCHESTER: Yellow, 8¼d. to 8½d.

SALAMMONIAC.—First lump spot. £41 17s. 6d. per ton d/d in barrels. SCOTLAND: Large crystals, in casks, £36.

SODA ASH.—58% spot, £5 12s. 6d. per ton f.o.r. in bags.

SODA, CAUSTIC.—Solid, 76/77° spot, £13 17s. 6d. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 12s. 6d. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £13 5s. to £14 contracts.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—LONDON: £21 per ton. SCOTLAND: £17 15s. per ton net ex store.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. SCOTLAND: £12 10s. per ton in 1 cwt. kegs, £10 15s. per ton in 2 cwt. bags. MANCHESTER: £10 10s.

SODIUM BISULPHITE POWDER.—60/62%, £20 per ton d/d 1 cwt. iron drums for home trade.

SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 12s. 6d. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANLHESTER: £3 2s. 6d. to £3 5s.

SODIUM SULPHIDE.—Solid 60/62% Spot, £10 15s. per ton d/d in drums; crystals 30/32%, £8 per ton d/d in casks. SCOTLAND: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 7s. 6d., d/d buyer's works on contract, min. 4-ton lots. Spot solid, 5s. per ton extra. Crystals, 2s. 6d. per ton extra. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8.

SODIUM BICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount 5%. Anhydrous, 5d. per lb. LONDON: 4d. per lb. less 5% for spot lots and 4d. per lb. with discounts for contract quantities. MANCHESTER: 4d. per lb. basis. SCOTLAND: 4d. delivered buyer's premises with concession for contracts.

SODIUM CARBONATE, MONOHYDRATE.—£15 per ton d/d in minimum ton lots in 2 cwt. free bags. Soda crystals, SCOTLAND: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality, 7s. 6d. per ton extra. Light Soda Ash, £7 ex quay, min. 4-ton lots with reductions for contracts.

SODIUM CHLORATE.— £29 per ton. SCOTLAND: 3¾d. per lb.

SODIUM CHROMATE.—4d. per lb. d/d U.K.

SODIUM HYPOSULPHITE.—SCOTLAND: Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals, £14 10s. ex station, 4-ton lots. MANCHESTER: Commercial, £10 5s.; photographic, £14 10s.

SODIUM METASILICATE.—£14 per ton, d/d U.K. in cwt. bags.

SODIUM IODIDE.—B.P., 6s. per lb.

SODIUM NITRITE.—LONDON: Spot, £18 5s. to £20 5s. per ton d/d station in drums.

SODIUM PERBORATE.—10%, 9¾d. per lb. d/d in 1-cwt. drums. LONDON: 10d. per lb.

SODIUM PHOSPHATE.—£13 per ton.

SODIUM PRUSSIATE.—LONDON: 5d. to 5½d. per lb. SCOTLAND: 5d. to 5¾d. ex store. MANCHESTER: 5d. to 5½d.

SODIUM SILICATE.—140° Tw. Spot, £8 per ton. SCOTLAND: £8 10s.

SODIUM SULPHATE (GLAUBER SALTS).—£4 2s. 6d. per ton d/d SCOTLAND: English material, £3 15s.

SODIUM SULPHITE.—Pea crystals, spot, £13 10s. per ton d/d station in kegs. Commercial spot, £8 15s. d/d station in bags.

SULPHUR.—£9 to £9 5s. per ton. SCOTLAND: £8 to £9.

SULPHATE OF COPPER.—MANCHESTER: £15 per ton f.o.b. SCOTLAND: £16 10s. per ton less 5%.

SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quality.

## Coal Tar Products

ACID, CRESYLIC.—97/99%, 2s. 6d. to 2s. 7d. per gal.; 99/100%, 3s. to 3s. 6d. per gal., according to specification; pale 98%, 2s. 9d. to 2s. 10d.; dark, 2s. to 2s. 1d. LONDON: 98/100% 1s. 4d.; dark, 95/97%, 1s. SCOTLAND: Pale, 99/100%, 2s. 3d. to 2s. 4d.; dark, 97/99%, 2s. to 2s. 1d.; high boiling acid, 2s. 6d. to 3s.

ACID, CARBOLIC.—Crystals, 6¾d. to 7½d. per lb.; crude, 60's 2s. 3d. to 2s. 6d. per gal. MANCHESTER: Crystals, 7d. per lb.; crude, 2s. 6d. per gal. SCOTLAND: 60's, 2s 6d. to 2s. 7d.

BENZOL.—At works, crude, 8½d. to 9d. per gal.; standard motor 1s. 2d. to 1s. 2½d.; 90%, 1s. 3d. to 1s. 3½d.; pure, 1s. 7d. to 1s. 7½d. LONDON: Motor, 1s 3½d. SCOTLAND: Motor, 1s. 6½d.

CREOSOTE.—B.S.I. Specification standard, 5¼d. per gal. f.o.r. Home, 3¾d. d/d. LONDON: 4¼d. f.o.r. North; 5d. London. MANCHESTER: 4¼d. to 5d. SCOTLAND: Specification oils, 4d.; washed oil, 4¼d. to 4¾d.; light, 4¼d.; heavy, 4¼d. to 4½d.

NAPHTHA.—Solvent, 90/100%, 1s. 5½d. to 1s. 6½d. per gal.; 95/160%, 1s. 8d.; 90%, 1s. to 1s. 2d. LONDON: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r. SCOTLAND: 90/160%, 1s. 3d. to 1s. 3½d.; 90/190%, 11d. to 1s. 2d.

NAPHTHALENE.—Crude, whizzed or hot pressed, £17 10s. per ton; purified crystals, £25 per ton in 2-cwt. bags. LONDON: Fire lighter quality, £5 to £5 10s. per ton; crystals, £27 to £27 10s.

PYRIDINE.—90/140%, 5s. to 7s. per gal.; 90/180, 2s. 3d.

TOLUOL.—90%, 2s. per gal.; pure, 2s. 4d. to 2s. 5d.

XYLOL.—Commercial, 2s. 1d. per gal.; pure, 2s. 3d.

PITCH.—Medium, soft, 36s. to 37s. per ton, in bulk at makers works. MANCHESTER: 30s. to 32s. 6d. f.o.b., East Coast.

## Nitrogen Fertilisers

SULPHATE OF AMMONIA.—The prices of this product have now been fixed for delivery up to the end of December as follows: July, 1936, £7 5s. per ton; August, 1936, £6 14s. 6d. per ton; September, 1936, £6 16s. per ton; October, 1936, £6 17s. 6d. per ton; November, 1936, £6 19s. per ton; December, 1936, £7 0s. 6d. per ton, for neutral quality basis 20.6% nitrogen delivered in 6-ton lots to farmer's nearest station. These prices are the same as those in force for July/December, 1935.

CALCIUM CYANAMIDE.—Up to the present prices for this product for July/December have not yet been announced, but it is understood that they are likely to be in line with last year's prices.

NITRO-CHALK.—The price of £7 5s. per ton has been fixed for delivery up to the end of September. This is the same price as that in force last year.

CONCENTRATED COMPLETE AND AMMONIUM PHOSPHATE FERTILISERS.—The prices for these products have not yet been fixed and at present it is impossible to give any indication as to the date of any announcement or of the trend of prices.

## Wood Distillation Products

ACETATE OF LIME.—Brown, £8 to £8 10s. per ton; grey, £10 5s. to £10 15s. Liquor, brown, 30° Tw., 8d. per gal. MANCHESTER: Brown, £9 10s.; grey, £11.

CHARCOAL.—£5 to £10 per ton, according to grade and locality.

METHYL ACETONE.—40-50%, £45 to £48 per ton.

WOOD CREOSOTE.—Unrefined 6d. to 1s. 6d. per gal., according to boiling range.

WOOD, NAPHTHA, MISCIBLE.—2s. 9d. to 3s. 3d. per gal.; solvent, 3s. 9d. per gal.

WOOD TAR.—£2 to £2 10s. per ton.

## Intermediates and Dyes

ACID, BENZOIC, 1914 B.P. (ex Toluol).—1s. 9½d. per lb.

ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.

ACID, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.

ACID NAPHTHIONIC.—1s. 8d. per lb.

ACID, NEVILLE AND WINTHER.—Spot, 3s. per lb. 100%.

ACID, SULPHANILIC.—Spot, 8d. per lb. 100%, d/d buyer's works.

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.

ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.

o-CRESOL 30/31° C.—6d. per lb. in 1-ton lots.

p-CRESOL 34-5° C.—1s. 6d. per lb. in ton lots.

m-CRESOL 98/100%.—1s. 7d. per lb. in ton lots.

DICHLORANILINE.—1s. 11½d. to 2s. 3d. per lb.

DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.

DINITROBENZENE.—8d. per lb.

DINITROTOLUENE.—48/50° C., 9d. per lb.; 66/68° C., 10½d.

DINITROCHLORBENZENE, SOLID.—£72 per ton.

DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works

α-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.

β-NAPHTHOL.—In bags, £88 15s. per ton; in casks, £89 15s.

α-NAPHTHYLAMINE.—Lumps, 1s. per lb.; ground, 1s. 0½d.

β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb., d/d buyer's works.

o-NITRANILINE.—3s. 11d. per lb.

m-NITRANILINE.—Spot, 2s. 7d. per lb., d/d buyer's works.

p-NITRANILINE.—Spot, 1s. 8d. per lb., d/d buyer's works.

NITROBENZENE.—Spot, 4½d. to 5d. per lb.; 5-cwt. lots, drums extra.

NITRONAPHTHALENE.—9d. per lb.; P.G., 1s. 0½d. per lb.

SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb.

o-TOLUIDINE.—9½d. to 11d. per lb.

p-TOLUIDINE.—1s. 11d. per lb.

## Latest Oil Prices

LONDON, July 1.—LINSEED OIL was steady. Spot, £28 (small quantities), July and Aug., £25 12s. 6d.; Sept.-Dec., £25 10s.; Jan.-April, £25 7s. 6d., naked. SOYA BEAN OIL was quiet. Oriental (bulk), spot, to Rotterdam, £23 15s. RAPE OIL was slow. Crude extracted, £34; technical refined, £35 5s., naked, ex wharf. COTTON OIL was steady. Egyptian crude, £25 10s.; refined common edible, £29; deodorised, £31, naked, ex mill (small lots £1 10s. extra). TURPENTINE was quiet. American, spot, 38s. 6d. per cwt.

HULL.—LINSEED OIL.—Spot quoted £26 10s. per ton; July and Aug., £25 15s.; Sept.-Dec., £25 12s. 6d.; Jan.-April, £25 10s. COTTON OIL.—Egyptian crude, spot, £26 per ton; edible, refined, spot, £28; technical, spot, £28; deodorised, £30, naked. PALM KERNEL OIL.—Crude, f.m.q., spot, £21 per ton, naked. GROUNDNUT OIL.—Extracted, spot, £32 per ton; deodorised, £35. RAPE OIL.—Extracted, spot, £33 per ton; refined, £34 5s. SOYA OIL.—Extracted, spot, £27 10s. per ton; deodorised £30 10s. COD OIL.—F.o.r. or f.a.s., 25s. per cwt., in barrels. CASTOR OIL.—Pharmaceutical, 42s. 6d. per cwt.; first, 37s. 6d.; second, 35s. 6d. TURPENTINE.—American, spot, 41s. 3d. per cwt.

## Company News

**Canadian Industries.**—A dividend of 1¾ per cent. is announced on the 7 per cent. cumulative preferred stock for quarter ending June 30, 1936, payable July 15, to shareholders of record at close of business on June 30, 1936.

**Baker Perkins.**—The report for 53 weeks to December 31, 1935, shows net profit £88,644 (against £70,682 the previous year); final ordinary dividend 3 per cent., less tax, making 6 per cent. (same); £2,500 to pension reserve (same); to general reserve £30,000 (£20,606).

**Sangers, Ltd.**—The net profits for the year to March 31 last are up by £32,353, to £188,723, and after bringing in £80,896 there is a balance of £269,619. The final ordinary dividend is 16¼ per cent., less tax, making 25 per cent., against 22½ per cent., and after providing £42,682 for tax the carry-forward is increased from £80,896 to £100,338.

**Cellulose Acetate Silk Co., Ltd.**—In the year to March 28, 1936, profit on trading (including £5,038 surplus on realisation of investment) amounted to £82,256, compared with £42,406 in the previous year, a rise of £39,850. After expenses, fees and depreciation, the net profit was £24,480, against a net loss of £13,582. The initial ordinary dividend of 2½ per cent. requires £18,045, leaving £48,862 to go forward, against £42,427 brought in.

**British Glues and Chemicals.**—For the year to April 30 last the profits at £86,841 were up by £15,370. This year's figure is struck after augmenting contingencies reserve by £15,000 and writing off the cost of goodwill of businesses acquired during the year. Dividends on the 8 per cent. preference shares, including ½ per cent. participation, take £44,625, and the 7½ per cent. ordinary dividend—the first since 1929-30—takes £13,125. General reserve is brought up to £60,000 by a transfer of £20,000. In addition to usual depreciation, £5,000 is written off machinery and plant and a similar amount provided for tax.

**New Transvaal Chemical Co.**—Interim dividends for half-year ended December 31, 1935, of 3 per cent. (less tax) are announced on cumulative first preference shares, and of 4 per cent. (less tax) on cumulative "A" preference shares.

**Zinc Corporation, Ltd.**—In their report for 1935 the directors state that the profit on mines trading account was £292,906, compared with £85,952 for 1934. Revenue from interest, dividends, etc., increased from £64,961 to £67,484, and special and non-recurring revenue of £23,098 was received during the past year. At £323,996, the net profit was £192,769 higher than in 1934. The appropriation account, including £51,490 brought forward, shows £379,083 available. Out of this sum the fixed preferential dividends have been paid, and the two participating dividends total 4s. 6d. per share, compared with 1s. 6d. per share for 1934. After re-appropriating £50,000 for mine development and new plant expenditure (£40,000 in 1934), and transferring £23,000 to profits equalisation reserve, there is left a balance of £54,708 to be carried forward.

## New Companies Registered

**Bradfield Chemical Products, Ltd.**—Registered June 18. Nominal capital, £500. Manufacturers of and wholesale and retail dealers in chemicals, gases and disinfectants of all kinds, etc. Directors: James A. Fox, Moorleigh, 102 Dryclough Road, Crosland Moor, Huddersfield; Wm. F. Whitaker.

**Metal and Electro Chemical Products, Ltd.,** 58 Victoria Street, London, S.W.1.—Registered June 27. Nominal capital, £500. Manufacturers of and dealers in chemical products and preparations, and in minerals, plant, machinery, and things capable of being used in connection with metallurgical operations; extractors, pumpers, drawers, transporters and purifiers of and dealers in petroleum and mineral oils, etc. Directors:—Walter G. Wakeman, Doreen G. Gibbons.



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